THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVII. No. 1704.] LONDON, JANUARY 7, 1896. [48TH YEAR. PRICE 6d.

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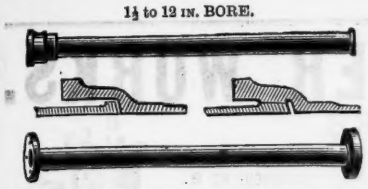
1½ to 12 IN. BORE.



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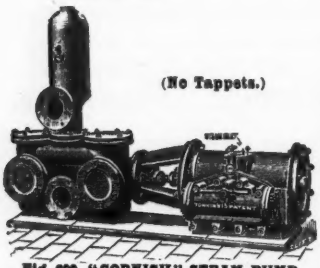

Fig. 600. "CORNISH" STEAM-PUMP FOR WATER.

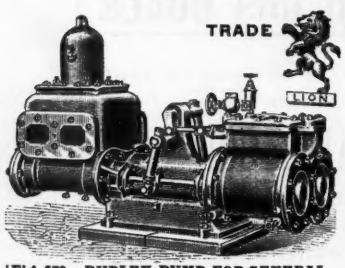

Fig. 670. DUPLEX PUMP FOR GENERAL PURPOSES.

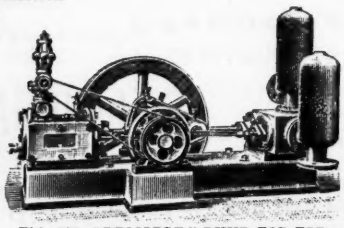

Fig. 685. "RELIABLE" PUMP FOR TAR AND THICK FLUIDS.

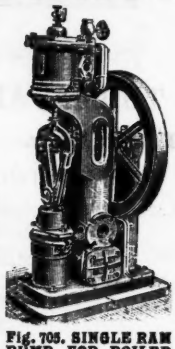

Fig. 705. SINGLE RAM PUMP FOR BOILER FEEDING, &c.

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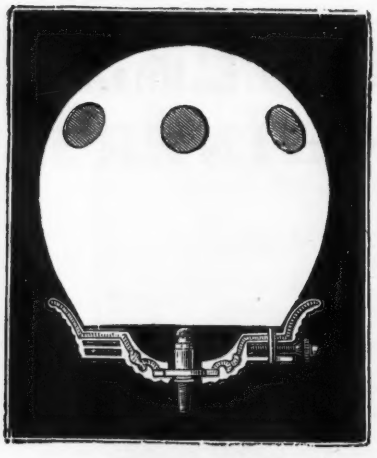

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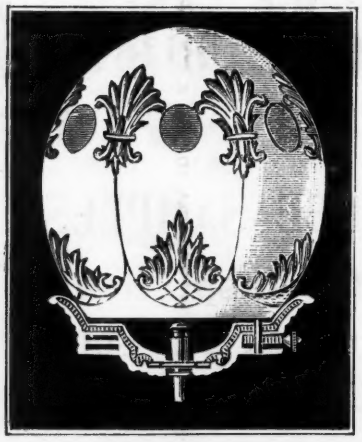

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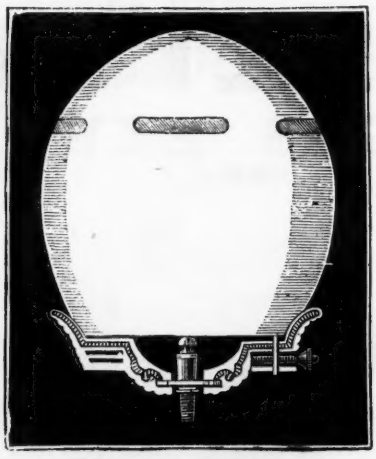

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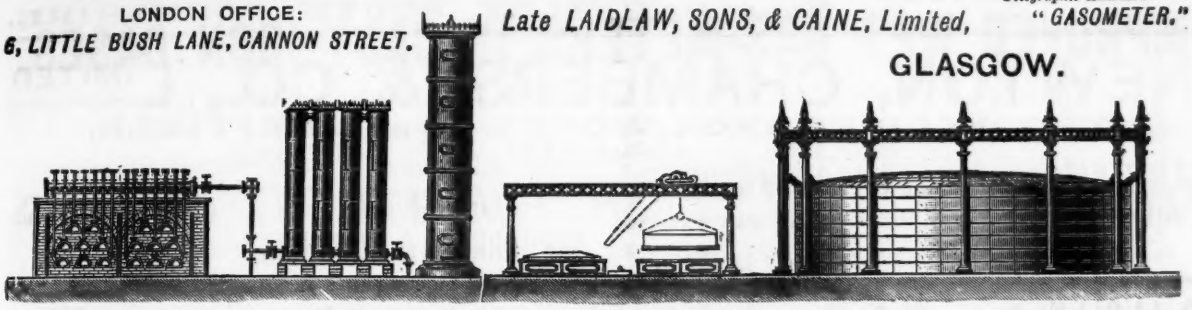

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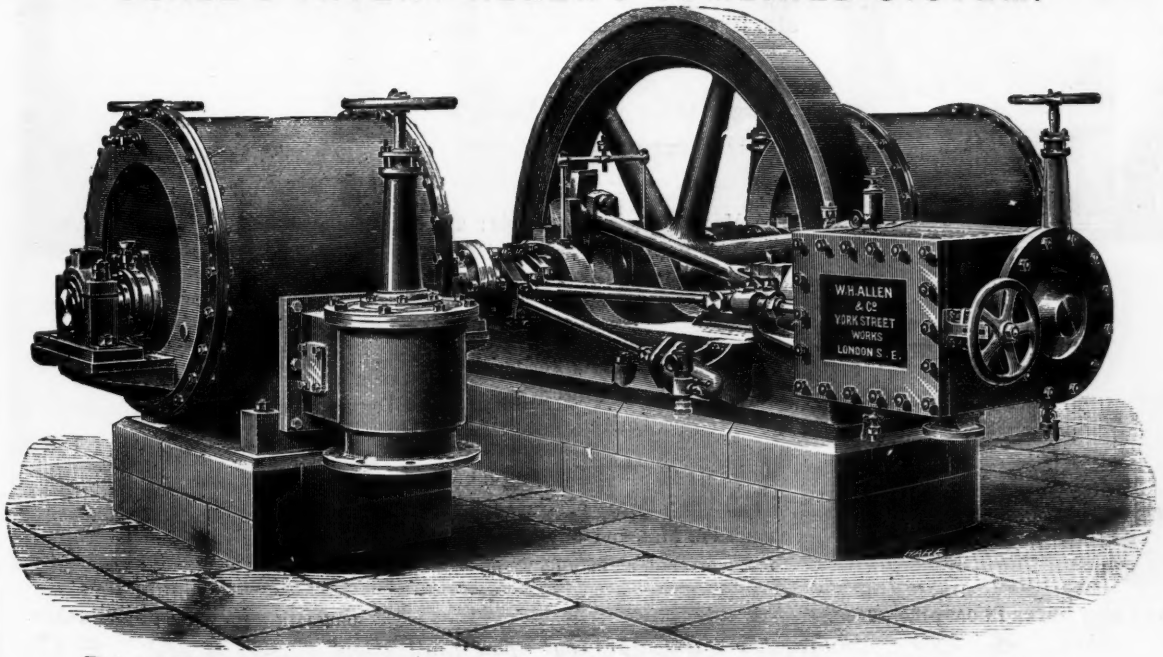

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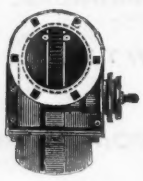

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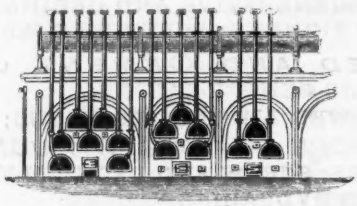

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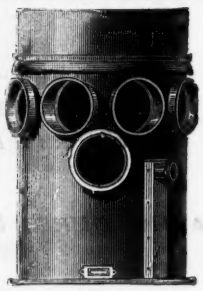

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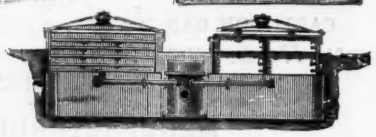

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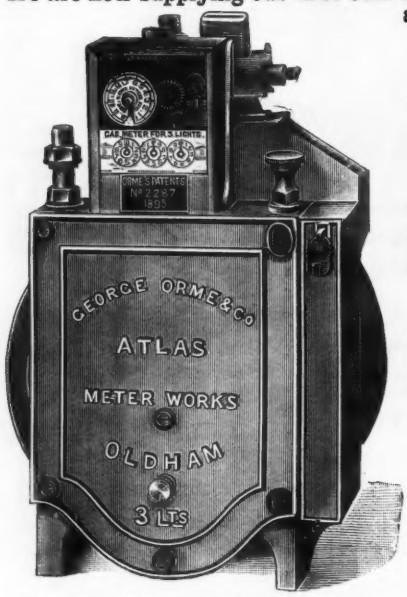

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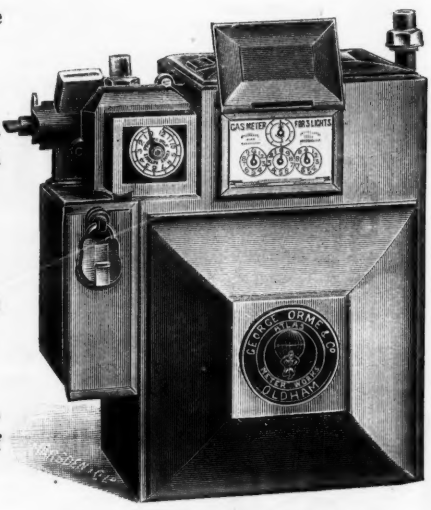

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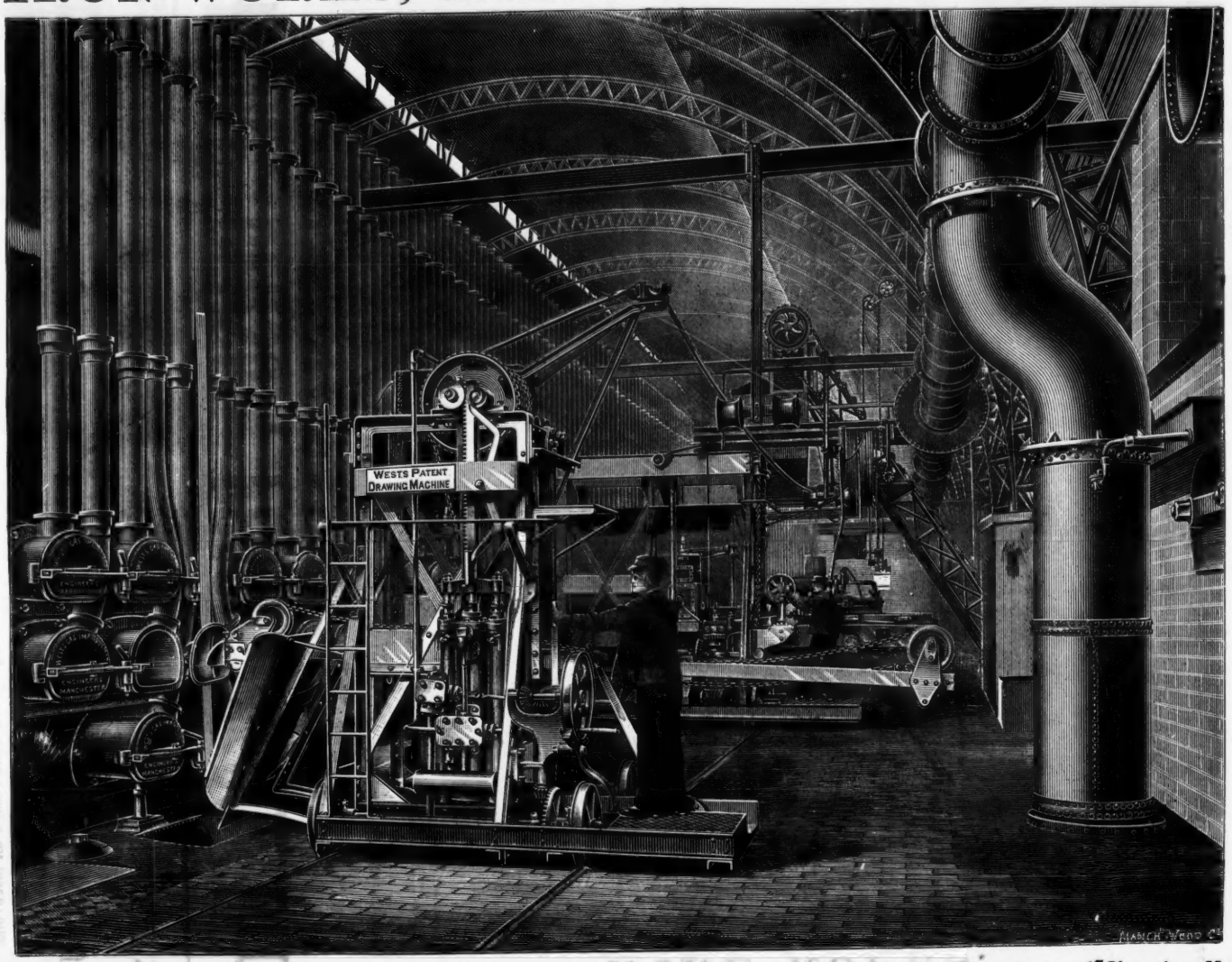

Interior of Retort-House at the Bradford Road Gas-Works, Manchester, showing the Compressed-Air Drawing and Charging Machines.

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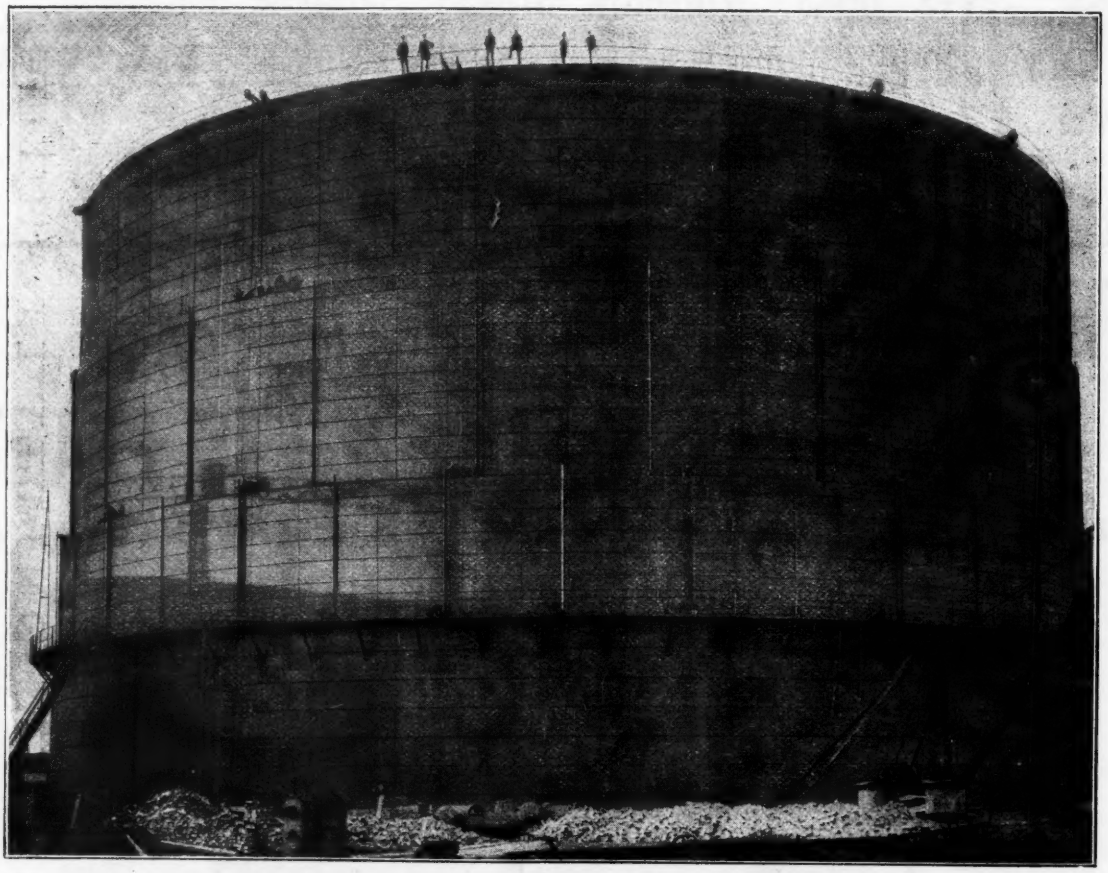

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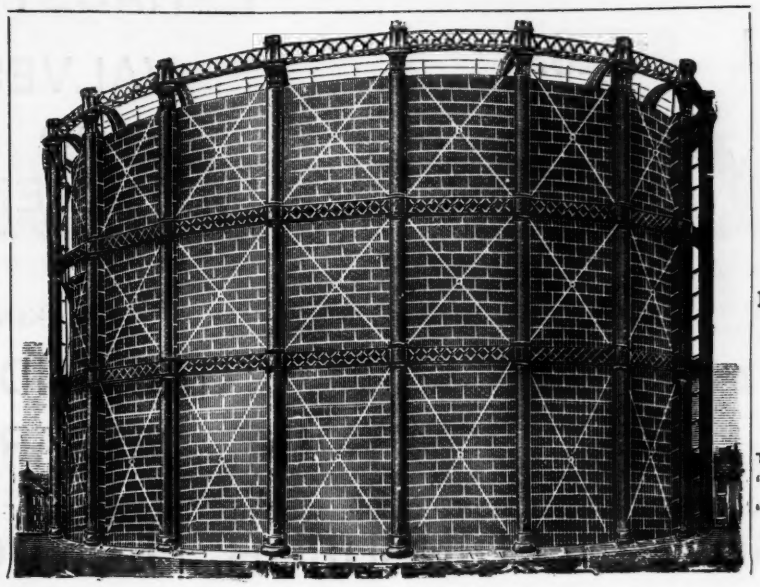

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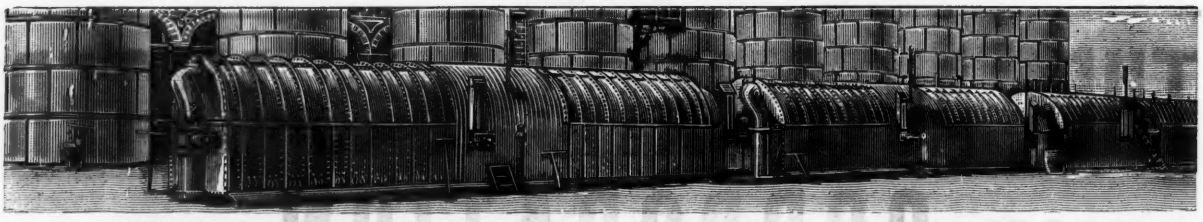

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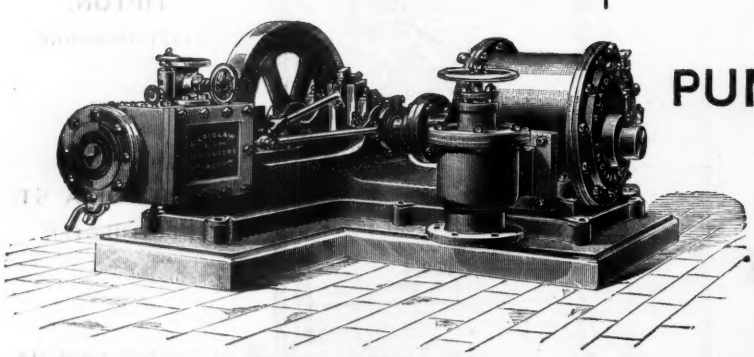

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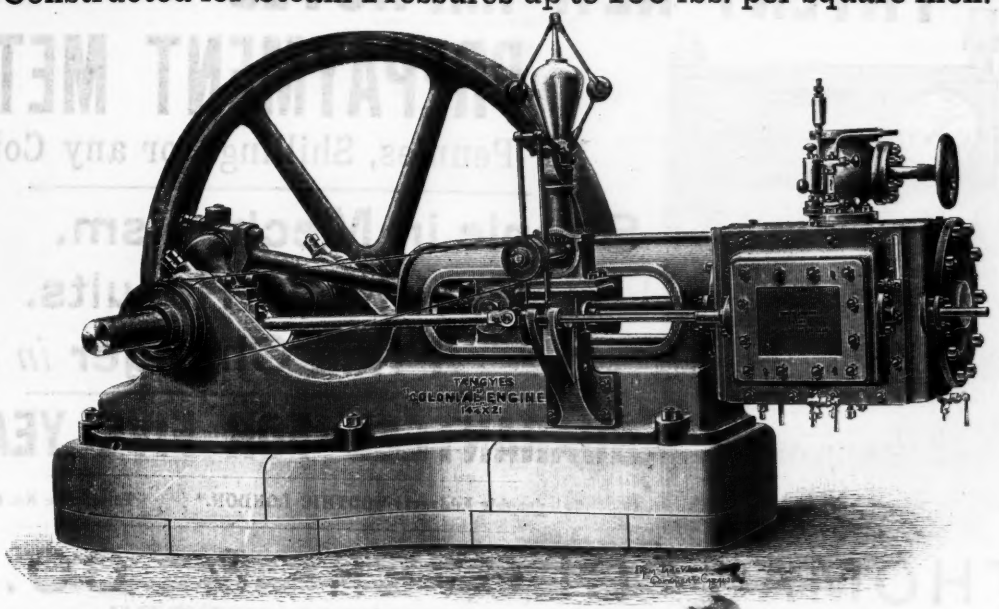
Constructed for Steam Pressures up to 100 lbs. per square inch.



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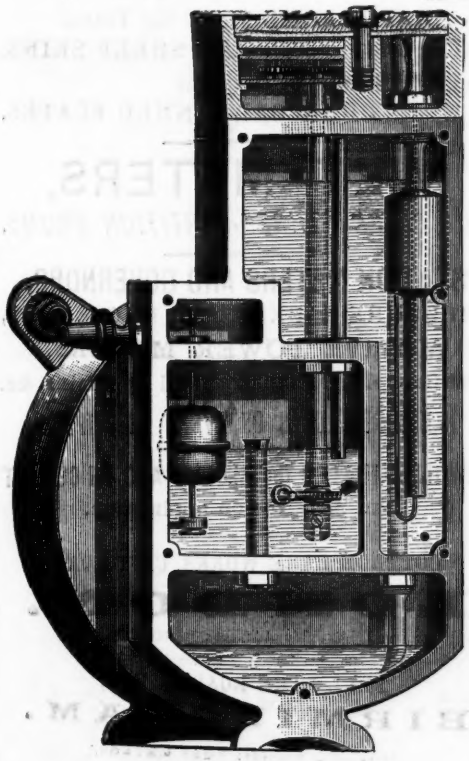

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Has been designed to obviate that which has hitherto prevented the general adoption of underground Meters—namely, their serious cost. No box is required; and the saving thus effected as compared with ordinary underground Meters, where either a box or meter-pillar is necessary, is fully one-half. The price of one for three lights is 28s.; and the other sizes are correspondingly cheap. When fixed, the only part of the Meter exposed to view measures 6½ inches by 3½ inches. By the Indicator with which the Meter is fitted, the Inspector can at once discern whether water is required; but as the Meter is of the compensating description, water will probably need only be supplied ONCE A YEAR. It is advisable to fill the Meter with a non-freezing liquid, which does not injure the fittings; and this can be supplied at about 1s. 3d. per gallon.

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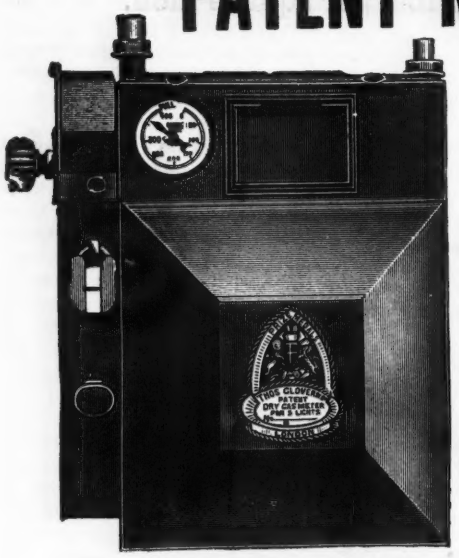

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EDITORIAL NOTES.

The State of the Coal Trade.

THE opinions we put upon record in our review of the events of the past year respecting the state of the national trade and industries during that period, are corroborated by the best independent testimony. It is stated by "The "Times" that the fact of there having been a general revival of trade in 1895 is proved by the Board of Trade returns of the imports and exports, the increased traffic receipts of the principal railways, and authentic reports of the condition of the most important home industries. In some departments, it is true, the depression has continued unabated, most notably in agriculture; and in some other departments foreign competition has been felt. Particular districts, devoted to certain special manufactures, have also not shared in the general prosperity of the country. Nottingham is named as one of these disappointing centres; and the staple manufacture of Lancashire has not been in good case. The metal and hardware industries appear to have thriven, on the whole; and the same is reported of the wool and woollen trades. The trades that look for their best market in the United States, however, are warned to be prepared for another era of hostile tariffs. In a special report on the coal-mining industry of Great Britain, "The "Times" confesses that "a more unsatisfactory year than "that which has just concluded" has seldom been experienced. We put the fall in the average market value of coal at 1s. per ton; and "The Times" puts it at from 10d. to 1s. 2d. per ton. "In other words, the average price of "coal at the close of the year is lower than the price that "has been current at any time during the last seven "years." This probably means a reduced income for coalowners of close on ten millions sterling on the output of the year, assuming the constancy of all working charges. The latter condition has not been fulfilled. The wages of miners have been reduced in a good many cases; but as against this the cost of stores has been increased. Coal, however, has remained at a low price, because it is a drug on the market. Over a very large area of mining operations it has been necessary to limit the output by working the pits for a reduced number of days in the week, according as the demand was brisk or stagnant. The result of this has been that very many of the most important collieries in the country have been working during the last six months under unfavourable conditions. Many pits have been kept open at a positive loss; and as regards a great many more, "the profits have not averaged "a penny per ton."

In view of the impossibility of continuing the present condition of affairs, we are told, many of the leading colliery-owners look forward to the future with a good deal of apprehension; because either the prices must be improved or the wages of miners must be reduced. It is stated that not even a reduction of wages by 10 per cent. would compensate the owners for the serious difference that has taken place in the realized selling price of coal; but it would be likely to go a very long way in this direction. This alteration, however, would not be easy to effect. The adjustment of miners' wages is now determined in the North of England and in South Wales by a sliding-scale based on the selling price; but in the other leading districts, and especially in the great Yorkshire, Derbyshire, and Lancashire coal-fields, there is no systematized method of arriving at the rate of wages which the men ought fairly to receive. Everybody knows what this has meant in the past; and anxiety is expressed as to what the future will bring. The miners have again and again declared that they will not submit to any reduction of the present rate of wages; while the employers have no difficulty in showing that unless the coal market makes a turn in their favour they cannot go on paying a rate of wages which is 30 per cent. above that of 1888, when coal was worth very nearly the same as it is now.

The prospect of anything like an effective combination of coalowners having for its object the maintenance or increase of the selling price of coal is discussed by "The "Times," but only to admit the impracticability of the idea so far as the whole British coal industry is concerned. The output of coals and coke in foreign countries has from time to time been "syndicated." But in all successful cases of the kind there has been a notable identity in the conditions to be dealt with. "Not so with the coal trade

"of Great Britain as a whole, which opposes one district "to another and one branch of the coal industry to "another at many different points—where each district "and each branch of the trade has more or less different "markets, and where uniform prices would be likely to "mean large profits to one and no profits at all to another, "according as the cost of production was higher or lower." Nevertheless, it is argued that while a regulated selling price or schedule of prices would be extremely difficult to create, it might not necessarily be impossible; "and it "would, at any rate, be worth a serious effort, in view of "what appears to be the likely alternative of another "conflict between the coalowners and their men." All this may mean anything or nothing; but it is at any rate talk that coal buyers may be commended to make a note of in view of possible developments.

The Case of Mr. Hurndall.

If the circumstances had permitted, our retrospective summary of accidents and casualties for last year in connection with gas supply would have contained some reference to the sad case of the Rev. W. E. Hurndall and his wife, particulars of which will be found in another column. As it happened, we have been obliged to wait for the inquest on the unfortunate gentleman in order to make sure of the facts, which turn out to be only too simple and commonplace. It has now been proved that Mr. Hurndall and his wife, who lived in a Westminster "flat," went to bed on the night of Saturday, Dec. 14, with a gas-fire alight in their room. It was not until some hour of the next afternoon that the room was opened from without, in consequence of the non-appearance of the occupants, when they were found in bed in a comatose state; the fire being still alight, and the atmosphere of the room such as to meet the incomer with a "hot blast of dry air." Notwithstanding all efforts to revive him, Mr. Hurndall remained in an insensible condition for two days, when he recovered consciousness. He had a relapse, however, and died on the 31st ult.; and Mrs. Hurndall is reported at the moment of writing as in a precarious state. The medical testimony given at the inquest was to the effect that the death was caused by primary suffocation and congestion of important organs, presumably "due to "breathing gas-fumes." The evidence of gas-fitters and others explained how the trouble occurred. The deceased, to begin with, had a by no means uncommon horror of "draughts." Draught-excluders were carefully fixed round the door, the windows were closed, and a plate was put over the register-opening of the fireplace, through which a hole was made only large enough to take the flue-pipe of the gas-fire, which stood in front of the grate. As one of the gas-fitter witnesses who carried out Mr. Hurndall's instructions for fixing his first gas-fire luminously expressed it, "his great idea seemed to be to exclude all "draught from the room." For some sufficient reason, this first gas-fire was replaced by another so recently as Nov. 14; the old fittings being used. The new gas-fire had at the back the customary projecting rim, upon which the flue-pipe was fitted; and this pipe had the usual elbow, and terminated at the end of the length which went up the chimney in a conical cap—again to exclude the possibility of down-draught. Now comes the fatal mischance to this very ordinary flue-fitting, that the bottom end of the flue-pipe by some means slipped off the stove-casting, and dropped down into the grate; the vertical pipe still filling up the hole in the plate closing the chimney. Consequently there were no means of escape, save into the room, for the products of combustion of the gas-flames; and the room was sealed as perfectly as possible by ordinary methods against the inflow of fresh and the discharge of foul air. Under such conditions, the production of an irrespirable atmosphere within the apartment was only a question of time; and, unfortunately, plenty of time was permitted on the occasion.

We are bound to comment upon this fatality at some length, and with particular reference to the circumstances, because it is just the sort of incident likely to be fraught with serious consequences to the gas industry and to the gas-stove trade unless the *rationale* of the thing is cleared up beyond the possibility of popular misunderstanding. Two witnesses at the inquest—an architect and friend of the victims, and a gas-fitter who with some degree of impropriety removed the stove after the accident without the knowledge of the Gas Company, whose servants fixed it—testified to the circumstance of the flue-pipe having dropped in the manner already described; and therefore the fact is to be accepted as proved. There is, however, no knowing when this happened. It was sought to be made a point of that the projection at the back of the stove-casting for taking the flue-pipe was only about an inch long, whereas it should have been longer in order to make a perfectly safe connection with the pipe. As the Coroner observed, possibly this is a good criticism; but such fittings are widely used, and "it would be a strange "thing to say there was any culpable negligence on the part "of anybody in fixing such a stove." Naturally, such a question might arise in connection with the whole set of incidental circumstances—such as the fit of the pipe, the liability of the stove to move, and so forth—with which we have nothing whatever to do here. The major consideration suggested by all the circumstances is that of the imperative necessity of properly ventilating living and sleeping rooms—a necessity which can only be ignored at the gravest peril. In the present instance, even with the flue-pipe of the gas-fire in its appointed place, what ventilation could there have been for this bedroom, with every chink and possible air-inlet stopped and caulked, and the only outlet for the products of respiration and combustion such room as might occur in the interstices of the packed "fuel" of the fire, with a 2-inch flue-pipe at the back? Again, why was the flue-pipe provided at the top, inside the chimney, with a conical cap? Obviously, as was stated, to prevent down-draught; from which it may be concluded that the chimney was liable to this reversal of its proper function. This is far from an uncommon trouble with the multitudinous chimneys of the modern "mansion" of flats; and possibly in the case in point it was one of the reasons for the preference given to a gas-fire. Fortunately, when there is a down-draught with an atmospheric gas-fire, the fact is usually announced by an intolerable odour which induces the opening of a window; thus restoring the proper course of the ventilation. In effect, the whole problem is one of ventilation; and upon this line it must be dealt with. This is the true lesson of the casualty.

The Affairs of the Amalgamated Society of Engineers.

It is to be expected that the trouble in the shipbuilding trade will soon be composed, now the holiday season is over. There was great force in the explanation offered of the men's recalcitrant attitude just before Christmas, that, if they had then consented to go to work, they would have had to "play" at their own expense during the holidays; whereas by remaining on strike they would have the advantage of strike pay throughout the whole of the time. In all probability, the Union officials will now try for a settlement, for fear lest the employers should elect to dispense with Society men altogether. Meanwhile, the particulars have been published in "The "Times" of the fresh actuarial report, according to which the finances of the Amalgamated Society of Engineers show a deficiency, or balance of net liabilities over assets, of close upon a million-and-a-half pounds sterling. This report is of the nature of a secret document, and must stand for what it is worth, inasmuch as the name of the author is not to be disclosed. His verdict upon the Society is sufficiently supported by evidence, however, to command the assent of all impartial observers of the state of things prevailing in the organization. Briefly, the Society is condemned as most hopelessly insolvent. Although by recklessly enrolling new members the organization may flounder on for a few years longer, it is absolutely impossible that it should continue for any length of time to meet its obligations. We cannot give here the details of the report, which will be found in "The Times" of the 26th ult. But it may be stated, by way of summary, that the Society, which has long enjoyed the reputation of being one of the strongest and richest Trade Unions in the world, had 66,790 full members on the roll at the end of 1894. The liabilities—which are the value of the benefits held out by the Society to its members and the cause of Trade Unionism generally—fall naturally under the two heads of trade contingencies, and sick and superannuation payments. In the former category are included what are called donation benefits, or out-of-work relief, the benevolent fund, and assistance to other trades. During the past six years, close upon £100,000 a year has been expended upon these objects, some of which could perhaps be spared for the

future if by so doing the Society could be saved. Almost an exactly equal yearly amount has been paid on account of sickness, superannuation, accidents, and funerals. As for the assets of the Society, these consist in the subscribing power of the members *plus* the balance in hand. That the subscribing power is strained almost to the breaking-point is proved by the fact that the annual payments per head have been forced up from £2 14s. 6d. in 1891 to £4 8s. 4d. in 1894, which is obviously more than men earning considerably less than £2 per week can fairly afford. Yet, taking a reasonable estimate of the average age and expectation of life of the subscribing members, and making a valuation only of the liabilities in the second category, it appears that there is a deficiency of the amount already stated in the assets. In order to render the Society solvent in respect of sick and superannuation claims alone, the members' yearly subscriptions would have to be raised to £5 12s. 6d. per head. This estimate does not take into account the expenses of management, now amounting to £23,000 a year; to say nothing of donation benefits and subsidies to other trades. To cover all these expenses on the scale hitherto followed, would entail an annual charge per member of upwards of £8 2s. 5d., or 3s. 1½d. per week. "That this "sum should be obtained seems impossible." It is tolerably certain that with the stoppage of the subsidies to other trades, would go the popularity of the Society in Trade Union circles; and the cessation of donation benefit would go far to deprive it of its charm in the estimation of its members. Yet if the claims of the members to sick pay, superannuation, and accident relief are to be safeguarded, everything else will have to be given up, and the Society changed from a fighting organization, whether for offence or defence, into a simple Friendly Society. The prospect will not be pleasant for those who have believed in the Amalgamated Engineers' Society as the flower of Trade Unions.

An Outrage on the Engineering Profession.

THE great heart of the engineering profession in the United States is being profoundly stirred by the outrageous conduct of certain municipalities, notably that of Terre Haute, Indiana, in presuming to require that successful competitors for designing certain school buildings needed by the city shall put themselves under bonds for the proper realization of their plans. The mischief is unhappily threatening to become epidemic; for what was started at Terre Haute has seemed to be worthy of imitation by the city of Holyoke, Massachusetts. This is indeed grave news; for while an evil of such magnitude merely manifested itself in the Western States, it might have been passed over as "an affair of outposts;" but when it is found to be striking inward to the neighbourhood of the "hub of the universe," the matter becomes serious. It appears that in the Holyoke case, Professor S. Horner Woodbridge, of Boston, was engaged to design a heating and ventilation system for one of the city school-houses. This task he seems to have performed with due regard to State law and to the usual standard that the building should be warmed to an internal temperature of 70° Fahr. "in zero weather." Whereupon he was asked to give a bond in the sum of $3000 that his designs would answer the purpose intended. His response to the humiliating proposition was truly professional, and took the form of a lecture on the difference between the responsibility of a consulting engineer to his clients and that of a contractor to his employers. It was a very good lecture, and, of course, left the professor in possession of the dialectical field. It admitted some of the *primâ facie* reasons why a consultant should be required to guarantee the soundness of his own advice; but it rested the case against this innovation upon the arguments "first, that a committee cannot, "under cover of a bond, shirk the responsibility of select-"ing a competent engineer; second, that those who are "most ready to secure patronage by declaring a readiness "to furnish bonds, are those upon whom the obligations "of a bond rest lightly, and who, by artifice, quibbling, and "protestation, are ready, and are generally able, to evade "them. Furthermore, the tendency of a general practice "of bond requirement would be to retire the better and "more conscientious engineers from the field, and leave "it to mercenary and unscrupulous competitors, who, "under the garb of professional engineering, claim the "public confidence and lighten the public purse." Of course, there can no more be any bonding of an engineer to do the best thing for his clients, than there can be of a general to win a campaign, or—to come closer to the mark—of an architect to render a building pleasing to everybody who looks at it. All the same, the sin of Terre Haute and Holyoke is not without a modicum of excuse; for engineers certainly have been known to make a terrible mess of jobs confided to them. We are not of those who worship the professional man, or take him always on his own recommendation, or on the reputation he has managed to create for himself, sometimes more by good luck than desert; and the proposition that those who give employment to a consultant have a right to expect value for their money is one that commands our acceptance. It does not follow, however, that an engineer in bonds is more to be depended upon than a free practitioner.

The Secretaryship of the Imperial Continental Gas Association.—Mr. G. F. Thompson has been compelled, on account of the state of his health, to resign his appointment as Secretary of the Imperial Continental Gas Association, and to retire from the service. He is succeeded by Mr. R. W. Wilson, the Assistant-Secretary. Mr. Thompson, it may be remembered, undertook the secretarial duties at the commencement of last year, upon the resignation of Mr. R. S. Gardiner.

The Management of the Singapore Gas-Works.—Mr. Albert Ford will take over the management of the Singapore Gas-Works in March next, in succession to Mr. H. W. Smith, the present Manager, who, as already announced in the "JOURNAL," has sent in his resignation. Mr. Ford has recently completed a three years' engagement with the City of Santos Improvements Company, Limited, as Engineer of their Gas and Water Works at Santos; and he is now with Mr. A. F. Phillips.

Obituary.—The death is announced of Mr. Albert F. Styles, a Director of the Maidstone Gas and Water Companies. Deceased was in his 59th year.——Mr. John Death, formerly an Alderman and four times Mayor of Cambridge, died last Saturday, at the age of 78. He was Chief Magistrate in 1873, 1874, 1880, and 1881, was a member of several public bodies, and a Director of the Cambridge Gas Company.——Alderman Major, whose death was recently announced from Wolverhampton, was one of the largest manufacturers in connection with gas residuals in the Midland counties.

Mr. W. Irwin on the Theory of Flame.—At the meeting of the Manchester Section of the Society of Chemical Industry last Friday, Mr. Wilfred Irwin read a paper dealing with the subject of the theory of flame. It may be remembered that last session he read a paper on the enrichment of gas [see "JOURNAL" for July 16 last], and was invited to continue his researches. He now discussed "The Effect of Heat on the Illuminating Power of Coal Gas, and its Relation to the Theory of Flame." He described some of the phenomena of flame; referring in particular to the stratification observable in an ordinary gas-flame—a point as to which, he remarked, we do not yet know all that is to be known. He said that, in certain experiments he had made, he had found that, on subjecting coal gas to a high temperature, there was a great reduction in the illuminating power. Luminosity he ascertained to be due to two different sets of reactions; and he pointed out that while one burner was more favourable to one set, another might be more favourable to another set. The results he obtained seemed to show that the argand burner is scarcely a fair method of estimating the commercial value of gas: and he suggested that a fairer method would be to take the average of the union-jet and the slit burners, which are those in every-day use. The discussion of Mr. Irwin s paper was postponed.

Explosions of Domestic Boilers.—The New River Company have issued to their consumers the following observations on the above subject, in compliance with the circular sent out by the Board of Trade, to which reference was made last week: "(1) The consumer should see that the communication-pipe is so laid and protected as to be secure against the effects of frost, and also that at any exposed points the pipe be thickly covered with some efficient non-conducting material. (2) Every boiler must be served from a cistern or service-box; and any direct communication between the boiler and the pipes of the Company is forbidden by the regulations authorized by the Board of Trade. The cistern should be sufficient for the requirements of 24 hours. (3) A safety-valve of proper construction should be placed upon every high-pressure boiler. (4) Every high-pressure boiler should be examined and cleaned out periodically by a competent workman. (5) Should the ordinary supply be interrupted, and the quantity of water stored in the cistern serving the boiler approach exhaustion, the fire should be immediately withdrawn until the boiler is cold, and measures have been taken for rendering the supply again available. It is extremely dangerous to allow water to enter a heated empty boiler." The Company, of course, point out that they have no responsibility whatever in relation to the construction or working of domestic boilers or fittings, the care and control of which rest absolutely with householders. It is quite necessary to make this point clear.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 37.)

[Our readers will notice that the Share List has been considerably extended. This has been done in compliance with suggestions we have from time to time received. In calling attention to the matter, we take the opportunity of again requesting secretaries of companies and others specially interested in the financial side of the gas and water industries to assist in making this portion of the contents of the "JOURNAL" as complete as possible by forwarding, as early as convenient, copies of reports and accounts, notices of dividends, and similar particulars.]

THERE was only one topic last week on the Stock Exchange, as everywhere else—viz., the deplorable incident in the Transvaal. As yet we know little about it beyond that the enterprise failed; and, in human affairs, ill-success is the one unpardonable sin. The markets bore it really better than might have been expected. Fortunately, Wednesday was a holiday, so that they had twenty-four hours in which to think it over, instead of opening wild and hot with the news fresh upon them. Of course, prices in many departments have gone down before it. Consols and Colonials have fallen materially; but the recession of the former was in part due to Money Market operations unconnected with South African affairs. Movements in many quarters were irregular, and not uniformly downward. Neither the Foreign nor the American market suffered much; while home rails were perhaps the chief losers. Bad as things were in the week, there was happily a better tendency at the close. The Gas Market meanwhile was quite unaffected by any other agency than those which are normal and seasonable. A holiday period, and a week broken in the middle, will always keep things quieter. The general tendency, however, remains unaffected. The demand for really first-class stocks is greatly above the supply. Recent rises in price naturally brought in a contingent of sellers. But now their stock has been absorbed, a number of demands remain unsatisfied; and these apparently will have to await a further rise before they can get what they want. There is very little to be noted in the business of the past week. Transactions were very limited, and hardly any changes took place. It was a week of suspended animation in fact. None of the Metropolitan Companies moved; and prices presented no noteworthy feature. Quotations remained unchanged. The Suburban and Provincial division was more conspicuous. Brightons and Brentfords were in demand; and the latter pushed up a couple of points higher. Alliance, however, recoiled half a point. The Continentals held their position at the old figures; and none of the rest made any move beyond a slight *ex div.* advantage in Australian and Buenos Ayres debentures. The Water Companies were very somnolent; but Lambeths show out better *ex div.*

We append, as usual, a comparative table of the quotations of Gas and Water securities at the close of 1895, and as they were twelve months previously. The fact that there has been a general advance all along the line of Gas undertakings testifies to the favour with which this industry is regarded as a field for the investment of money; while the extraordinary advance in the value of the Metropolitan and Suburban Companies is attributable to the enormous and continuing demand for a solid 4 per cent. security such as their open stocks afford. Their debenture issues meanwhile are pushing well forward among the "gilt-edged" select. The contrast presented by the Water Companies is the result of the great frost of 1895, which affected some of them very severely.

NAME.	Prices on Dec. 31, 1894.	Prices on Dec. 31, 1895.	Gain or Loss.
GAS COMPANIES.			
Alliance and Dublin Company, 10 per cent.	19⅛—20¼	22⅛—23⅛	+3
Do. 7 per cent.	13⅜—14⅜	16⅜—17⅜	+3
Australian (Sydney) 5 per cent. Debentures	105—107	107—109	+2
Bombay, Limited	6½—6⅝	6⅝—7⅛	+½
Do. New	4½—5	5—5⅛	+⅛
Brentford, Consolidated	233—238	268—273	+35
Do. New	185—190	210—215	+25
Brighton and Hove, Original	217—222	227—232	+10
Bristol	115—120	124—128	+8½
British	48—49	54½—55½	+6½
Bromley, ordinary 10 per cent.	21⅞—22⅛	22⅛—23⅛	+1
Do. 7 per cent.	16⅞—17⅛	19—20	+2½
Buenos Ayres (New), Limited	6—7	7⅛—8⅛	+1⅛
Do. 6 per cent. Debenture	101—104	102—104	+½
Cagliari, Limited	27—28	30—32	+3½
Commercial, Old Stock	272—277	323—328	+51
Do. New do.	200—205	251—255	+50½
Do. 4½ per cent. Debenture Stock	130—135	147—152	+17
Continental Union, Limited	239—243	263—268	+24½
Do. 7 per cent. Preference	205—210	210—215	+5
Crystal Palace District	117—122	127—132	+10
European, Limited	22⅛—23⅛	25⅛—26⅛	+3
Do. Partly paid	16—17	17—18	+1
Gaslight and Coke, A, Ordinary	251—256	295—300	+44
Do. B, 4 per cent. maximum	105—110	107—112	+2
Do. C, D, and E, 10 per cent. Preference	277—282	287—292	+10
Do. F, 5 per cent. Preference	130—135	135—140	+5
Do. G, 7⅛ per cent. Preference	200—205	200—205	—
Do. J, 10 per cent. Preference	275—280	287—292	+12
Do. K, 6 per cent. Preference	165—170	169—173	+3½
Do. 4 per cent. Debenture Stock	127—130	135—140	+9
Do. 4½ per cent. Debenture Stock	135—140	145—150	+10
Do. 6 per cent. Debenture Stock	188—192	200—205	+12½
Imperial Continental	225—230	232—236	+6½
Malta and Mediterranean, Limited	5—5⅛	6—6⅛	+1
Metropolitan of Melbourne 5 per cent. Debenture Stock	110—112	113—116	+3½
Monte Video, Limited	15—16	16⅝—17½	+1⅝
Oriental, Limited	7—7⅛	7⅞—8⅛	+⅞
Ottoman, Limited	4⅛—4⅜	5—5⅛	+⅝
Pará, Limited	1⅝—2⅛	1⅛—1⅜	—⅜
People's Gas of Chicago, 1st Mtg. Bds.	100—105	105—110	+5
Do. 2nd do.	95—100	100—105	+5
San Paulo, Limited	8½—9½	11—12	+2½
South Metropolitan, A Stock	337—342	377—382	+40
Do. B do.	287—291	308—313	+21⅛
Do. C do.	293—298	325—330	+32
Do. 5 per cent. Deb. Stk.	169—174	175—178	+5
Tottenham and Edmonton, A Stock	225—230	250—255	+25
WATER COMPANIES.			
Chelsea, Ordinary	287—292	292—297	+5
East London, Ordinary	232—237	215—220	—17
Do. 4½ per cent. Debenture Stock	150—155	155—158	+4
Grand Junction	120—123	112—117	—7
Kent	305—310	310—315	+5
Lambeth, 10 per cent. maximum	267—272	245—250	—22
Do. 7½ per cent. maximum	205—210	207—212	+2
Do. 4 per cent. Debenture Stock	135—138	143—148	+9
New River, New Shares	385—390	380—390	—2½
Do. 4 per cent. Debenture Stock	140—145	143—143	+3
Southwark and Vauxhall, 10 per cent. max.	167—172	150—155	—17
Do. 7½ per cent. maximum	160—165	139—142	—22
West Middlesex	275—280	288—293	+13

ELECTRIC LIGHTING MEMORANDA.

The Swansea Triple-Effect Scheme—Resolution of the Swansea Town Council—An Exploded Refuse-Burning Project.

THE extraordinary scheme propounded by Mr. E. Manville, by which Swansea is to be supplied with electricity for lighting and working the tramways at the price of 1½d. per unit, by the help of refuse destructors, was discussed at the last meeting of the Town Council for the past year. Particular interest was imparted to this discussion by the circumstance of a strong and representative deputation of townsmen attending to express an adverse unofficial view of the scheme. The proceedings illustrated the point made in some of our recent "Electric Lighting Memoranda" as to the grave responsibility that weighs upon members of local authorities when brought face to face with projects of this character. We do not know who Mr. Manville is, nor do we care to know more about him besides the published fact that he has made himself responsible for a proposal in regard to the electric lighting of Swansea which is before the world for judgment upon its merits. This is the central fact of the Swansea business; and it is for the Town Council in the first place, and the townspeople ultimately, to make up their minds as to what is to be done about it. This is a grave issue for an average town councillor to be charged with determining; and the burgesses are amply justified in exhibiting anxiety as to how it is likely to go. The Town Council appear to be favourably impressed by Mr. Manville's scheme, though no independent authority has, to our knowledge, supported it, save with much reserve. The leading technical journals will not commit themselves to approval of the idea. In its issue for the 13th ult., the "Electrical Review" remarked that it "has yet to be proved in practice" that anything at all approaching Mr. Manville's estimate of the possible reduction of the cost of electrical production by the aid of refuse destructors is realizable. The utmost that the St. Pancras destructors at the King's Road station have yet been able to do, is to supply sufficient heat for the economizer, and keep 45 lbs. of steam in a small stand-by boiler. The most favourable conclusion to which our contemporary can arrive on this head, from data known to itself, is "that during hours of light load a destructor may provide steam, or that even during heavy loads this, combined with thermal storage, may aid economical working." But the question is a purely financial (or commercial) one; and "at present no favourable balance has been shown." The "Electrician" is equally cautious in this regard. Of course, all such schemes are in a way interesting; but Mr. Manville's is eminently one that those who most admire the author's ingenuity would prefer to see tried at somebody else's expense.

This is very much the view taken by the deputation which attended the Swansea Town Council meeting. It was headed by Dr. T. D. Griffiths—probably as good a man to deal with a matter of this kind as could be found in the Council. He made a speech in which Mr. Manville's figures were severely handled; concluding by begging the Corporation "not to launch in a precipitate manner on these schemes of uncertainty without some security." This speaker was followed by Mr. A. Sinclair, described as an electrical engineer, who defied Mr. Manville to prove the validity of his "Christmas novelty," and claimed triumphantly to have "knocked the whole bottom out of the scheme" by the aid of figures supplied by the author himself. After three members of the deputation had spoken in the same

sense, the Council proceeded to discuss a resolution empowering the Corporation to proceed with the Bill for the acquisition of the tramways, with a view to working them by electricity. This style of playing with the fringe of the subject at issue is quite in the orthodox manner of local authorities, and was, of course, temporarily successful—the resolution being carried by a large majority. So the matter stands for the present, so far as the Corporation of Swansea are concerned. It is hardly to be supposed, however, that the business will rest for very long without further developments, which will be awaited with interest both within and beyond the borough.

The consideration of the refuse destructor scheme for Swansea recalls other projects of the kind. One of the most outrageous of these was brought under public notice last month by the proceedings at the statutory meetings of creditors and contributories held under the winding-up order issued against the British Steam Generator and Refuse Utilization Company, Limited. This was the Company that proposed to exploit the "Livet" system of steam raising from town's refuse, with the object, among others, of providing cheap electric lighting. It may be remembered that the promoters had an "installation" to display the system at Halifax, which was subjected to an organized "press view" of the too familiar type—a party of newspaper reporters who knew nothing whatever about boilers, or steam raising, or refuse burning being taken down from London at the promoter's expense, and treated to a view of the boiler (and a few other things) in order that they might write up the venture in their various influential "organs of public opinion." If we remember aright, an illustrated newspaper published a sketch of the engineer to the Company, effectively posed upon a heap of old boots and empty sardine tins, while he read a paper to the distinguished party setting forth the peculiar excellences of this kind of fuel. Well, the bubble was not long in bursting; but the history of the Company, so far as it has been disclosed, is a highly instructive chapter in the record of modern "promoting." The inventor, M. de Livet, first formed the usual Syndicate, which was to raise a modest capital of £10,000, and pay the meritorious inventor £500 in cash. This programme could not be carried out; but another promoter came upon the scene who made no difficulty about floating a Company with a capital of £600,000, of which the inventor was to receive £500,000 as the purchase price of 50,000 shares of £10 each. This arrangement being concluded, matters proceeded in the usual way. Cash advances were obtained from various sources, an engineer was engaged, a "show" was prepared, and the journalistic ground-bait already mentioned procured. How much money was actually subscribed for shares in the Company has not transpired, though 210,590 shares of £1 each were formally allotted, and the Directors proceeded to negotiate for the sale of "concessions" in the customary style. Meanwhile the inventor died; and his unfortunate widow received from the Company not more than £300 of all the splendid remuneration to which she was nominally entitled. The affairs of the Company are being investigated by the Official Receiver; and it is expected that, in the result, several lights of the financial world will be made somewhat uncomfortable. If managers of the newspapers who fell in with the designs of these personages retain a vestige of conscience, the "press view" as an institution may happily be abolished.

The Institution of Civil Engineers have just issued a new edition of their list of members. The Institution has been in existence 78 years; and it now numbers 20 honorary members, 1854 ordinary members, 3750 associate members, 345 associates, and 825 students—a total of 6794 members of all classes.

Reported Combination of Coal Producers.—According to a report in circulation early last week, a combination has been formed among East of Scotland and Lothian producers of cannel gas-producing coal, to raise the price. The charge for best cannel coal has declined to below 20s. per ton; whereas three years ago the quotation was 35s. It appears that producers have large stocks on hand; and the present time is regarded as favourable for forming a combination. It is understood that the Muirkirk gas-coal fields will be included in the combination.

Projected Trades Exhibition at the People's Palace.—A project is on foot for holding at the People's Palace next June an exhibition of East London trades, industries, and arts, and work of polytechnics and technical institutes. Section I. will comprise exhibits of manufacturing and trading firms, for which diplomas of merit will be awarded. Group VI. in this Section will be devoted to the engineering and metal trades, and will include steam, gas, and oil engines; while in Group VII. (Food and Cookery) cooking appliances will be found. In Group XXV. the residual products of gas manufacture will be included. Sections II. and III. will contain exhibits by individual craftsmen, students, and apprentices; and scope will be afforded for a display of their ability in (among other branches of industry) plumbing, gas-fitting, and lamp-making. Prizes will be awarded. A guarantee fund of £8000 to £10,000 is being formed to meet the expenses—£6000 having been already received; as well as donations to the amount of £1000. The Hon. Secretaries are Messrs. H. Boulton and E. Flower; and their offices are at 64, Cannon Street, E.C.

COKING PLANT FOR GAS-WORKS.

The account we gave last week of the coal carbonizing and residuals recovering plant at the Lanchester Colliery should revive the interest in such matters created in members of the gas engineering profession some years ago, when tentatives, more or less successful, were made in the direction of establishing a special industry of coal carbonizing distinct both from the gas and the coke industries. It is by no means easy for any but those particularly concerned in such affairs to keep well posted in regard to the course of these technical developments. There certainly was a period, which is perhaps not even now past, when coal was being carbonized in the United Kingdom with three distinct objects—for making illuminating gas, for making metallurgical coke, and for the ammonia and liquid products of its dry distillation. At the present time it seems that the first of these objects of coal carbonizing is the only one that persists in its pristine character; the metallurgical coke industry is in course of being profoundly modified in the direction so well exemplified at Lanchester; while the third class of coal carbonizing works appear to have been crowded out by the expansion of the two others. At any rate, there does not seem to be any longer that sufficing reason for their existence which undoubtedly prevailed when the possibility of recovering the ammonia and liquid bye-products of coal carbonization was yet unproved outside gas-works. Generally speaking, it may be said that the improved coke-retort, in successfully challenging the beehive oven, has extinguished the coal products factory. This view of the situation seems to be the correct one, notwithstanding the existence here and there of a small establishment of the latter order. And when we speak of this order of factory, we mean a coal carbonizing establishment based upon the same principles of operation that are followed in gas-works—small retorts (horizontal or inclined) fitted after the usual gas-works fashion, and producing coke of the same quality as gas coke. The very existence of such an industry depends on favourable market conditions; and these have ceased to offer much inducement to manufacturers of products which the gas manager is glad to dispose of at any price because he cannot regulate the output to the demand.

If the coal products' industry is flourishing anywhere, we shall be glad to hear of it, if only for the sake of the light which methods of carbonizing coal with different objects are capable of throwing upon the operation of gas-retorts. The problem of continuous carbonization, for example, might be attacked, one would think, more hopefully in products' works than in ordinary gas-works; yet one does not hear of anything being done in this direction. Meanwhile, it is certain that such progress is being made in the effective carbonization of coal in mass as to give point to the observation of Mr. S. R. Ogden, of Blackburn, in his recent paper read before the Manchester District Institution of Gas Engineers, about the expediency of adding coke-producing plant to the resources of a gas-works. Plenty of published information is available as to the various improved coking plants and systems which offer themselves as suitable for this purpose. Besides the Simon-Carvès system, as applied at Lanchester and elsewhere in Durham, there are the Semet-Solvay system, adopted by Messrs. Brunner, Mond, and Co., and the Brymbo Steel Company, the Coppée plan, preferred by Messrs. Crawshay Bros. at Cyfarthfa, the Brunck, the Otto-Hoffmann, and others. The working of the Semet-Solvay ovens—or retorts, as we prefer to style all these externally-heated coal-stills—has been described by Mr. John H. Darby in communications published in the "Journal of the Society of Chemical Industry," and alluded to in our own columns. In one of these it is stated that the Semet-Solvay plant at Brymbo, after a year's working, has been found to satisfy all the author's anticipations. The structural unit is a battery, or bench, of 25 retorts; these being narrow chambers about 33 feet long, 5 feet high, and about 18 inches wide, surrounded by the heating-flues. A point is made by Mr. Darby that the width of the retort should be governed by the character of the coal to be coked. "As a general rule, rich coals with a high percentage of volatile matter should be treated in wider ovens; lean coals, with a small percentage of volatile matter, should be treated in narrow ovens." Such a retort holds a charge of four tons, and is burnt off in 22 hours. The author ascribes the successful working of the system (1) to the considerable mass of the supporting walls; (2) to the thin sides of the channel bricks in the heating-flues on the side nearest the oven; (3) to the adoption of horizontal side flues; (4) to the arrangement of heating-flues on each side of one supporting wall; (5) to the fact of the coking being done in a closed chamber; (6) to the facility for changing all parts of the retorts subject to wear and tear. He states that, in most types of retort ovens, the heating-flues are built in the mass of the supporting walls of the ovens; whereas in the Semet-Solvay plan they are independently built up of comparatively thin bricks. There does not appear to be anything very wonderful in this arrangement. The retorts are heated as follows: After the coal-gas has been deprived of its bye-products, it is conducted back to the bench to be used as fuel. There are three side flues to a retort. Gas and heated air enter the top one on the ram side of the stack, pass along the whole length of the setting, and then the products of combustion turn downwards to enter the second flue. Here a second supply of gas and hot air is admitted; and

all the gases go together through the flue to the end, where they descend to the third flue, and so return to the front. Here the waste gases from both sides of the retort unite, and pass together through a flue underneath the bottom of the retort to the main flue. The retort gas has the following percentage composition :—

Carbonic acid	3·27
Carbonic oxide	7·95
Oxygen	0·23
Hydrogen	52·77
Nitrogen	1·99
Light carburetted hydrogen	31·22
Olefines	2·57

The retorts are worked at a slight pressure, to keep out air; and the gas (from washed coal) is stated to be of from "12 to 14 candle power, while clean coal from the same seam treated in gas-retorts would yield gas of 16½-candle power." Of course, these figures must be taken for what they are worth, as the circumstances of testing are not given. The yield of bye-products per ton from a fairly rich coal in the Semet-Solvay retort is about as follows: 5 per cent., or 112 lbs., of tar; 1·3 per cent., or 30 lbs., of sulphate of ammonia; and 3 gallons of light oil, sp. gr. ·89. The waste heat of the retort-flues will evaporate 0·6 lb. of water per pound of coke made. Another and later account states that the gas from these retorts, before the absorption of its benzene, has an illuminating power of 16 to 17 candles, with a good coal; and the yield is after the rate of 10,000 cubic feet per ton. It will be noticed that these statements respecting illuminating power and yield of gas are couched in general terms, and need corroborating. If they are reliable, it would appear that coal might as well be carbonized for gas making in bulk as in small charges.

The Brunck oven, or retort, is described by the designer as being 32·8 feet long, 6·56 feet high, and from 15 to 21·5 inches wide, according to the quality of the coal to be coked. In this design, as in the Semet-Solvay plan, the weight of the roof is borne by solid piers; but the retorts are set in pairs in the arches. The flues by which the retorts are heated are vertical. In an installation of Brunck ovens at Kaiserstuhl, near Dortmund, charges of 7·2 tons of coal (containing 14 per cent. of water), were coked in 34½ hours, including the time occupied in charging and emptying. The yield of tar produced by this system is stated to be 13·4 per cent. greater, and of sulphate of ammonia 9·5 per cent. greater, than from retorts on the Coppée-Otto system. But why this should be so, is not apparent. A very complete coal washing, conveying, and coking plant upon the Coppée system has been erected at Cyfarthfa, and was illustrated in the "Engineer" for the 6th ult. The arrangements at these coke-retorts are described as very complete. The benches are in two lines of 90 retorts each; and the whole system is capable of dealing with 500 tons of coal per day. The waste heat of the benches makes steam in ten large Lancashire boilers. The coke resulting from the washed coal only shows 7·4 per cent. of ash. The fact of such a plant being adopted at the Cyfarthfa Iron-Works shows there is no valid objection to the use of the coke in the best class of furnaces.

These illustrations of the growth of the improved coke-ovens or retorts in the favour of colliery-owners and of ironmasters all teach the same thing, and this is the expediency of gas engineers taking steps to test the principle by the standard to which they are accustomed. Two coke-retorts could be easily made in an ordinary retort arch, each occupying the vertical space usually appropriated for three horizontal retorts. Plenty of side heat seems to be necessary for these coke-retorts; bottom heat being almost a secondary consideration. Such retorts could be built up of thin tiles, well supported by outside piers. Four-ton charges, to be worked off in 24 hours, would compare favourably with the working capacity of horizontal or sloping retorts. It would be highly desirable to test the quality of the gas given off hour by hour from such a charge. This would probably result in showing that the gas of the last hour or so had better be put away by itself. The effect of steaming the coke towards the end of the charge would also be an interesting subject of study. It would, of course, be desirable to make provision for pushing out the coke by a ram, as the coke makers do. It is essential, however, that no illusions should be cherished as to the possibility of constructing a self-discharging retort by any means short of inclining the whole thing at an angle of 32 degrees with the horizontal; and the small expense of a mechanical ram is not to be compared with the structural cost of such an erection. As was remarked in the article upon the Lanchester plant, it is worth while to make machinery for dealing with such masses of material. Another point that an experimental coking plant in gas-works might be efficacious in clearing up is the effect of pressure in consolidating coke during its solidifying stage. Very soon after the charge of coal begins to feel the heat of the retort, it fuses into a plastic mass; and it is a question whether, if it could then be compressed by means of heavy iron plates, perforated for the passage of the gas, or by other suitable means, the density of the coke could not be thereby increased, with commensurate effect upon its value.

These are a few only of the considerations suggested by the progress of the improved coke-ovens in iron-works and at collieries. It has been a reproach to English coal and iron masters that they have been slow to appreciate the advantages of this kind of plant. But a change has set in in this respect; and the competition of foreign iron has done more of late to open the eyes of the British manufacturers to the wastefulness of the old beehive oven than any number of lectures or papers emanating from interested sources. Of his favourite Semet-Solvay system, Mr. Darby says: "If these ovens were added to a combined blast-furnace and open-hearth steel plant, 2·8 tons of coke could be manufactured per ton of steel made—the waste gases from the ovens supplying all the heat required for the furnaces, and for the re-heating and rolling of the steel; while on the supposition that 15 cwt. of pig iron are required (*plus* scrap) per ton of steel, about 30 cwt. of excess pig iron or 36 cwt. of coke could be sold for every ton of steel made. In such a case, the coke-ovens would be heated by producer gas, consuming 2½ cwt. of small coal per ton of coke made; and the whole of the oven gas would be utilized outside." Where, may one ask? At any rate, the prospect is not without its disturbing elements, for more than one industry. It is computed that upwards of 15 million tons of British coal go yearly to the making of metallurgical coke. If all the bye-products were recovered, there would be an additional 200,000 tons or thereabouts of sulphate of ammonia to be disposed of, and tar in proportion. It may be long before the limits of practicable economy in this direction are attained by all the colliery proprietors and ironmasters of the United Kingdom. But this is the way in which the most advanced of them are now moving, by giant strides; and the effect of the new developments cannot but be felt on all sides.

SERVICEABLE CHEMISTRY.

THE issue of a second edition, revised and brought up to date, of Professor Vivian B. Lewes's manual of chemistry for the use of officers of the two services, is evidence of the degree in which the author's effort to bring together in convenient form those facts and principles of the science which naval and military men ought to know, has been appreciated by those to whom it was primarily addressed. We are glad to have the opportunity of bringing this work again under the notice of readers of the "JOURNAL," not only out of respect for the author, whom they in other capacities know so well, but also because the book contains a good deal of matter that is in point of fact quite as much a concern of gas engineers as it can be of the students at the Royal Naval College. It is perfectly true, as the author is careful to point out, that "there is but one chemistry," however desirable it may be for special reasons to discuss the science in respect to its technical adaptation to any particular set or class of applications. It is equally true, notwithstanding, that men engaged in practical affairs can with difficulty be interested in abstract sciences. It is very well to tell officers of the Army and Navy, or even engineers engaged in civil occupations, that they ought to study chemistry, or mathematics, or physical science. The counsel is perfectly just; but the chances are that when a practical man, or a student of some technical development, attempts to follow it without further guidance, he will get hold of a text-book which seems to him to be stuffed with matter only calculated to addle the brain that attempts to grapple with it, and to be as far removed as possible from any application in which he may be interested. It is only necessary to dip into any number, picked up at random, of the "Philosophical Magazine" or the "Comptes Rendus" to find that the physicists, mathematicians, and chemists who are the lights of their respective sciences usually exercise themselves in disquisitions which it requires a good deal of faith to regard as of value to anybody in the workaday world. An interpreter is, in fact, needed to translate the messages of pure science to working men; and hence it follows that when a competent person undertakes this office for a particular science and a special application, he really performs a service to a wider public than that immediately addressed by him. For it is impossible for such an intermediary as Professor Lewes to discourse to his chosen audience respecting the bearing of chemical science upon the subject of fuels, the spontaneous ignition of coal cargoes, and similar matters, without equally interesting all who have to do with such things.

It was six years ago when Professor Lewes first set about collecting into a volume the heads of his courses of lectures on "Service Chemistry;" and he and others have done a good deal of chemical work since then, much of which has been "boiled down" for the present volume. Two chapters have been added to the work, and the others have been rearranged and to a considerable extent rewritten. We are not going to criticize Professor Lewes in any detail; but there are one or two points of his teaching which appear to call for reconsideration. For instance, he repeats on p. 97 the assertion to which he gave currency in his first edition, on the authority of Perkins, that "if a boiler has been allowed to run dry and the plates have been highly heated, on the entrance of feed water the first portions assume the spheroidal state; but as more water is added and the plates are gradually cooled, contact takes place, with formation of enough steam in many cases to cause

* "Service Chemistry: Being a Short Manual of Chemistry and its Applications in the Naval and Military Services." By Vivian B. Lewes, F.I.C., F.C.S., Professor of Chemistry, Royal Naval College, Greenwich, &c. Second and revised edition; illustrated. London: W. B. Whittingham and Co., Limited; 1895.

explosion." Now, it has been one of the devoted labours of Mr. Longridge, the well-known Engineer to the Manchester Steam Users' Association, by crucial experiment to dispose of this fallacy, which he was led to investigate by calculations of the small amount of heat which the plates of a boiler-tube can store up even if raised to a red heat. It might have been better, moreover, if Professor Lewes had paid a little more attention to the subject of boiler explosions while he was so near the subject.

The author has something to say about drinking water and its purification; but it is rather remarkable that he omits all reference to the self-purifying capacity of certain kinds of polluted water, seeing the part that this phenomenon has played in the watering of ships in the old days, and does still perform in connection with town water supplies. There may be "old salts" yet living in or near Greenwich who can remember filling ships' butts from the foul water of the "Pool" of London. The practice continued to much later days, if it is even now abandoned, at the smaller estuarial harbours round the coast, where the water was always taken in before a cruise by simply dipping from alongside. Of course, at first and for some time afterwards, water obtained from such a source was undrinkable, and stank abominably. In due course, however, it cleared itself and became extremely sweet and limpid—with the further remarkable quality of being immune from "going bad" again. It used to be said that well or spring water, when left in the customary open butt of the coaster or short-voyage trader, would "go bad" and never get right again. Chemists and biologists will probably find no difficulty in explaining these traditional puzzles by the aid of the never-failing microbe; but it is a pity for them to be overlooked, because it is by the aid of such weapons that the college-scorning "salt" habitually demolishes the "high-learned" graduate. Speaking generally, the "keeping" qualities of drinking water are not sufficiently regarded by the experts who pronounce judgment on the character of water supplies.

Of course, Professor Lewes instructs his pupils rationally, and therefore acceptably, on the subject of coal gas, which he calls "our most important illuminant." He has replaced the analysis which served in the first edition to give his readers "a good general idea" of the composition of coal gas, by three analyses of the ordinary coal gas "as supplied at the present time by the three great Companies lighting the Metropolis." These were given in the second of the Professor's lectures under the University Extension Scheme at the Stratford Town Hall two years ago, and reported in the "JOURNAL" at the time; but we reproduce them here:—

Constituents.	South Metropolitan.	Gaslight and Coke.	Commercial.
Hydrogen	52·22	53·36	52·96
Unsaturated hydrocarbons	3·47	3·58	3·24
Saturated hydrocarbons	34·76	32·69	34·20
Carbon monoxide	4·23	7·05	4·75
Carbon dioxide	0·60	0·61	0·75
Nitrogen	4·23	2·50	5·10
Oxygen	0·49	0·21	0·00
	100·00	100·00	100·00

The modern form in which the results of these analyses are given will strike the old-fashioned reader accustomed to look for marsh gas and olefines in lists of coal gas constituents. The author proceeds to discuss the question as to which of the components the light-giving power of coal gas is due. He concludes that "there is no doubt but that methane is certainly one of the most important of the hydrocarbons present, when the gas is burnt in such a way as to evolve from it the proper illuminating power; while the benzene vapour, small as the quantity is, comes next in importance, and the ethylene last. It is the combined action of the hydrocarbons which gives the effect; not any one of them acting alone." The author goes on to explain the phenomena of luminous combustion according to his own ideas on the subject, in which the formation and subsequent decomposition of acetylene play an important part. "Acetylene is one of those compounds termed endothermic, from the fact that heat is absorbed during their formation, and at the moment of decomposition this heat is again liberated, and having no time to dissipate itself amongst the other gases present, heat [*sic*] up the carbon particles to a temperature far higher than the average temperature of the flame, causing them to become incandescent, and so rendering the flame luminous; the incandescence of these solid carbon particles being further aided by the temperature of the flame and by their own combustion, partly by the oxygen of the air, and partly by the action of water vapour and carbon dioxide upon them"—here follows a triad of chemical equations; "and it is the combustion of the carbon monoxide and hydrogen which gives the outer non-luminous envelope to the flame." This is a breathless sentence, in which even the eloquent Professor seems to have "lost his number;" and we hope he will in future cut up his statements into more manageable doses. To start again: "The small blue portion of the outer envelope at the base of the flame is caused by the rapid inrush of air, the nitrogen so diluting the hydrocarbon molecules at that point that they are burnt up without being first decomposed; and there being therefore no separation of carbon, there is no luminosity, and the same blue colour may be observed when a gas-flame is rendered non-luminous by dilution with nitrogen or carbon dioxide. This explanation holds good for all luminous hydrocarbon flames." All this, and more—about the atmospheric gas-flame—is new in the present volume.

The paragraphs about gas-burners have been subjected to some correction, not always in a style calculated to give universal satisfaction. For example, in his first edition, Professor Lewes credited the Welsbach burner with giving "a very pure white light." But now the best he can say for it is that it gives "a greenish white light." In another place, the author states that whereas the duty of the incandescent burner is 6 candles per cubic foot of gas consumed, that of the regenerative burner is 10 candles. This does not seem to be quite right. The regenerative burner, in the most enduring patterns, is as good and as deserving of popularity as ever it was; but it has not held its own during the past five years against the competition of the incandescent type of burner. Professor Lewes has a good deal that is eminently fair and highly instructive to say about fuels, water gas, spontaneous combustion in coal, the protective painting of iron, and other matters of paramount interest to the gas engineer. It is hardly necessary to observe that he is a safe guide to the "inwardness" of a vast number of subjects of practical moment; but he makes a little stumble sometimes over minor points, as when he tells his readers that in the manufacture of white lead the "rather clumsy (Dutch) process has been of late superseded by more rapid methods." There may be more rapid methods in operation in places; but the old process of acetic acid and tan stacks will probably last out our day, and perhaps longer, albeit there is a fortune waiting for anybody who can materially improve upon it.

In taking our leave of Professor Lewes for the present, we have to express the pleasure which his clear and masterly style of exposition has once more afforded us, and to commend his latest book to a place upon the bookshelves of practical gas engineers, where it will be at least as much at home as upon the study table of the scientific soldier or sailor.

A High Water-Tower.—The highest artificial structure in America is the water-works tower at Eden Park, Cincinnati. The floor of the tower (reached by elevators) is 522 feet above the Ohio River; the base is 404 feet above the stream. If the height of the elevator shaft be added to the observation floor, the grand total height is 589 feet.

The Toxicity of Acetylene.—Further reference to this subject has recently been made in the "Comptes Rendus." M. Brociner states that acetylene exerts merely a feeble poisonous action, not more marked than that of the ordinary hydrogen carbides, such as formene, ethylene, or propylene. Animals exposed to the action of mixtures containing considerable proportions of acetylene for several hours do not succumb if care is taken to operate in the presence of a considerable quantity of oxygen, and to renew the gaseous mixture so as to prevent the products of the animal's respiration from accumulating.

Gas-Mains, &c., and Urban Roads.—At the meeting of the Institution of Junior Engineers on the 6th ult., Mr. J. Julian, of the Borough Engineer's Office, Cambridge, read a paper on "Urban Roads and Footpaths, with Notes on Gas, Water, and Electric Mains, &c., in Connection Therewith." In the course of his paper, the author gave a brief description of the overhead and conduit electric and mechanical cable systems. Various modes of laying electric mains were described, and particulars were given as to cost, &c. Water and gas mains were noticed; and with reference to these, the author presented several formulæ for obtaining first approximations. Details of joints were illustrated; while an estimate given for laying a main showed the importance of taking into account the cost of restoring the surface of the road. Attention was next directed to hydraulic, pneumatic, and steam power mains; and some remarks were made on pipe-laying generally.

The Columbus (Ohio) Gas Company's Profit-Sharing Scheme.—In the JOURNAL for the 19th of November, reference was made to the profit-sharing scheme adopted by the Columbus (Ohio) Gas Company, respecting which some particulars were furnished at the recent meeting of the American Gaslight Association by Mr. Emerson M'Millin, the President of the Company. We have since learnt from Mr. M'Millin that the scheme is made to apply to all employees who have been in the service of the Company for a year or more prior to the beginning of the six months for which a dividend is paid. The dividends to the stockholders being at the rate of 5 per cent. per annum, the Company pay their men 5 per cent. every six months on the amount of wages earned by them during the previous half year. This is for "continuous and faithful service;" and any employee failing to render such service is not entitled to the dividend. The scrip certificate issued specifies that the men are required to take their dividend in stock. This holds good until they have either received as dividends or purchased stock to the amount of $300. When they are *bonâ fide* holders of as much as three shares of the stock (par $100), they are to receive, if they prefer it, dividends in cash. The Directors think the effect has been very good. It simply means an increase of 5 per cent. in the men's wages, while making them stockholders of the Company. Mr. M'Millin says the "sentimental effect" of receiving the same rate of dividend, and at the same time, that the stockholders are paid, is very great, both with the employees and the community at large.

NOTES.

The Contraction and Stretching of Iron Castings.

In a suggestive paper read at a meeting in Chicago of the Western Foundrymen's Association, Mr. Thomas D. West discussed the contraction of iron castings, and drew attention to the generally overlooked fact that cast iron also expands at the moment of solidification. The author began by referring to the stereotyped rule of the pattern maker, which allows for a contraction of $\frac{1}{8}$ inch to the foot run; and he remarked that none but pattern makers of small experience, or with experience limited to particular classes of work, would believe that such an allowance is correct for all dimensions of castings. Moulders having wide practice in general machinery work know that there will usually be a difference in the contraction of any two forms which differ in their proportions, even when poured with the same iron. Also the form of the mould, and the manner in which it is made and the casting is cooled, have much to do with the ultimate size of the casting, as compared with that of the pattern from which it is made. It is not practicable to set up fixed rules for the contraction of castings; the best results being obtainable when designers, draughtsmen, pattern makers, and moulders are made aware of the principles that govern the various phenomena of the solidification and cooling of castings. Mr. West cited the example of a couple of bars both cast from a pattern 14 feet long, but one being 9 in. by 4 in. and the other only 2 in. by $\frac{1}{2}$ in. in section. These bars were cast together with the same gates; and though both were of similar iron, there was a difference of $\frac{1}{8}$ inch in the amount of their contraction. He offered, by way of explanation of this fact, the hypothesis that it is a question of the time allowed for the graphite to separate out from the state of combination in which it exists in the fluid iron. If this is the correct view, it follows that the length of time occupied in cooling a casting after the metal has solidified may often be more effective in causing different degrees of contraction and hardness in a casting of ordinary grey foundry iron than any varying proportions of sulphur, silica, &c., which usually exist in it. According to Mr. West, cast iron expands only at the moment of solidification. The "stretching" of iron is due to artificial influences modifying the operation of contraction. It can produce castings larger than the patterns, and also renders it possible to make acceptable castings under conditions when success could not otherwise be obtained. Mr. West asserts that it is only the fact of cast iron being capable of stretching within certain limits that prevents many castings from going to pieces; and he warns designers to observe due proportion in castings with the object of relieving the material from internal strains.

Fractures of Water-Gauge Glasses.

Mr. Lavington G. Fletcher, the Chief Engineer to the Manchester Steam Users' Association, has issued a memorandum on the subject of the fracture of glass water-gauges, which have become increasingly troublesome and dangerous since the range of boiler pressures has been raised. These breakages are stated to be due to a variety of causes, which have for some time past been made the subject of particular study by Mr. Fletcher and his staff. The correct lining and steadiness of the brass mountings are the first considerations to be attended to when glass gauges are found to break frequently. The tubes themselves should be obtained from such makers as can be relied upon to use only first-class material and to carefully anneal the tubes when made. In cleaning the tubes, it is also essential that they should not be scratched, as insignificant scratches often develop into important fractures. An efficient guard for the gauge-glass should always be provided. Mr. Fletcher observes that a vulcanized, conical, flanged ring, on the principle of the hydraulic cup leather, has been brought out for packing the tubes in their sockets, in place of the ordinary rings. By this conical flanged ring, elasticity is afforded; so that in case there should be any slight movement of the brass fittings, the glass tube will not be strained. Mr. Fletcher has not had sufficient experience of the behaviour of these conical packing-rings at high pressures to speak positively of their success; but he thinks they promise well enough to be worth trying.

Rock Temperatures at Great Depths.

The question of rock temperatures at great depths is an important one in connection with the larger problem of the depth to which it may be found practicable to mine coal and other minerals. Lord Kelvin has deduced an increase of 1° Fahr. for every 51 feet of depth; and the observations of temperature made in connection with the piercing of the St. Gothard Tunnel gave an increase of 1° Fahr. for 60 feet. Professor A. Agassiz now states, in a communication to the "American Journal of Science," that for several years past, with the assistance of Mr. Preston C. F. West, the Engineer, he has been making rock temperature observations as the operations of the Calumet and Hecla Mining Company have been carried on at increasing depths. At the deepest point, a depth of 4712 feet has now been reached; the temperature having been taken so low as 4580 feet. It is proposed to go to a depth of 4900 feet, when the details of all the observations will be published. The highest rock temperature reached, at 4580 feet deep, was only 79° Fahr.; the depth of 105 feet, at which local temperature variations would appear to have become negligible, showing a temperature of 59° Fahr. This gives an average increase of 1° Fahr. for every 223·7 feet, which is a very different result from previous data already furnished. From these observations it would follow that the earth's crust must be upwards of 80 miles thick; and the thickness of the crust at the critical temperature of water would be upwards of 31 miles, instead of from seven to over eight miles as deduced from the older ratios.

Argon in Inflammable Natural Gas.

It is more than a century since the gases rising from certain mineral waters were first tested for the purpose of determining their nature and qualities; and now the same kind of experiments are being carried on all the world over, with the object of ascertaining whether, and to what extent, the newly-discovered gases argon and helium occur free in Nature. Mr. C. Lowthian Bell, of Middlesbrough, recently sent for testing a sample of inflammable gas collected from "Allhusen's Well." The examination was conducted by Professors Ramsay and Kellas, who have communicated their results to the "Chemical News." The most obvious constituents of the sample were removed in the usual way, by the employment of the regulation absorbents; the only noticeable feature of the operation being the stubbornness of the hydrocarbon, which for long resisted the attractions of red-hot copper oxide. The circulation had to be continued for two days before the hydrocarbon was completely absorbed. In the end, about 0·4 per cent. of "indifferent gas" remained in the hands of the experimenters, which it is to be supposed would a short time since have been regarded as representing errors or defects of treatment, of no importance in the analysis. The spectrum of the residuum was carefully compared with that of argon, and the lines were all found to be coincident. No new lines appeared, nor was any helium yellow visible. An incombustible gas from another well at the same place was also tested, and was found to contain 0·5 per cent. of argon.

The Waste of Steam in Small Pumps.

A remarkable disclosure respecting the wastefulness of steam, and consequently of fuel, in a large factory where additional pumps and other machinery had been put up promiscuously to meet requirements as they arose, has been made by Mr. Charles E. Emery, in a paper read at the last meeting of the American Society of Mechanical Engineers. Mr. Emery was called in to advise an Oil Company in New Jersey how to reduce their fuel account; the consumption of coal for raising steam having risen by degrees to 64,000 tons per annum. Mr. Emery found that besides a large amount of steam required here for heating purposes, a great deal was needed for pumping, pressing, and so forth. It was found that many of the steam-pumps were using as much as 240 lbs. of water per net horse power per hour; and only in exceptional cases could one be found to take so little as 80 lbs. of feed-water per horse power. Mr. Emery recommended the establishment in the works of a number of power stations, in which would be erected good high-pressure non-condensing engines operating power pumps to take the place of the scattered steam-pumps; the exhaust from such engines to be distributed by mains for heating purposes. A small electric transmission was also recommended for reaching outlying parts of the works. The recommendations were adopted, with the net result of reducing the consumption of fuel by one-half. A large electric power scheme was rejected on the score of its cost. Electric light is employed about the works; the switches in places where a spark might ignite inflammable gases or vapours being immersed in oil to render them sparkless.

Belt and Rope Driving.

Professor David S. Capper recently submitted to the Institution of Mechanical Engineers some observations on the experiments carried out by the Northern Industrial Society of France to determine the comparative efficiency of rope and belt driving. The experiments were troublesome and expensive to carry out; but they resulted in showing that, at the horse power employed for the purpose, which was about 160, there was practically no appreciable difference between the two methods of driving. To have demonstrated this single fact is a result of sufficient value, though the tests did nothing to solve the more important question of the actual power absorbed by the gearing. Professor Capper refers to earlier experiments on driving-belts, which had for their object the determination of the limit of load, under ordinary working conditions, beyond which a belt will slip on its pulley. The researches of Lenza and others have rendered it possible to prevent excessive loss from slip; but there still remain residual losses—slip due to elasticity, work in overcoming the stiffness of belts, reduction of the coefficient at high speeds by centrifugal action and by air—about which very little is definitely known. Experiments show that in well-designed belt gearing the total loss does not exceed 3 or 4 per cent. of the gross power transmitted; and the Lille trials now prove that ropes are practically quite as efficient as belts. Professor Capper regrets that, while they were about it, the Committee did not extend the limits of the research. But he admits that the difficulties were great, and that the increased outlay would probably have been large.

TECHNICAL RECORD.

DIFFERENTIAL PHOTOMETRY.

By Dr. W. H. Birchmore.

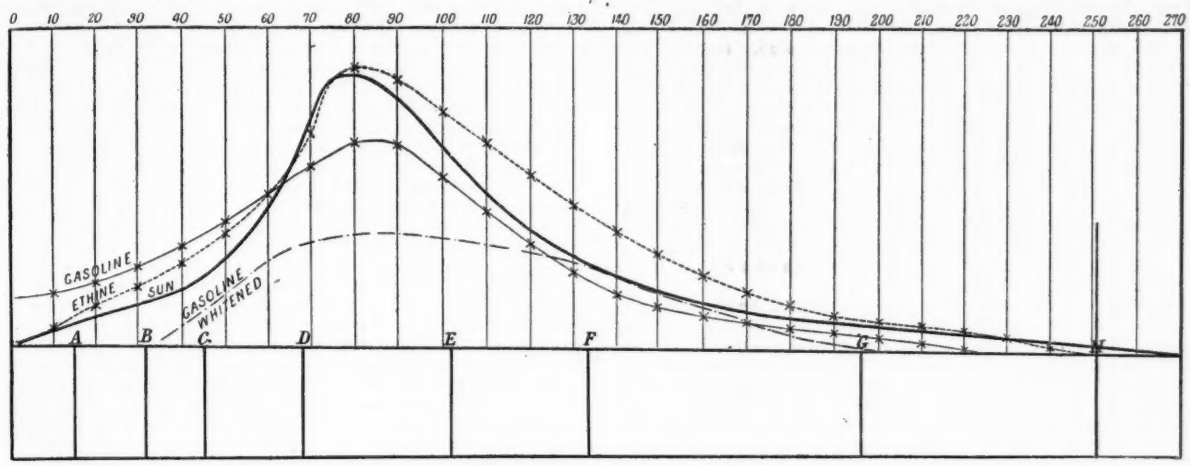
[Prepared for the "American Gaslight Journal."]

The mensuration and comparison of the illuminating value of the total spectrum of various sources of light have for a long time employed the attention of various observers; but, with the exception of the work of Professor Pickering, there is surprisingly little known of the comparative luminosity of the small portions of the spectra of various illuminants that may, for purposes of comparison, be considered as homologous parts. The classic Fraunhofer's curve was made with appliances and under conditions that render it useless except as a convenient diagram. Still I have used it for comparison, not because I believe it to represent anything, but because everyone knows what it is intended to represent, and would instinctively compare every other curve that might be offered to it.

The Unit of Comparison.—Professor Pickering's monograph proved conclusively that the standard candle was nearly as unfit a unit for comparison as it was possible to obtain; and it may be that this has damped the ardour of those who started to follow the way he had so well pioneered. But as there is a standard candle, it was needed to "tie the sun to a post," as the land office surveyors phrase it. The precise method to be used has puzzled me greatly, when by chance a routine question for the candle-power-hour value of a gallon of astral oil suggested a way.

A standard candle that was burning more than usually well was taken as the arbitrary unit, and from this the determination of a lamp was made. This was then duplicated, and the two lamps compared with care for a long time; and by this a proximate standard of comparison was obtained. The final development of this experiment was a round-wicked kerosene oil-lamp—a "night lamp," in fact, with a wick ½ inch diameter—which lamp, set to burn to a fixed point marked on the chimney, consumed 0·1 oz. of Pratt's astral oil per hour so completely as to leave no provable presence of unconsumed hydrocarbons. I have therefore assumed that lamp as the unit for my work; and, for the purpose of comparison, I choose to call it a "candle power."

The Method of Curve Delineation.—The spectrum was projected for observation at such distance that the combination employed (Kirchoff-Bunsen) would represent about 270 mm.; and in the diagram annexed this is the proportion used. The precise



Illumination Curves [Reduced] of Sunlight, Ethine Flame, Gasoline Air-Gas Flame, and the latter passed through a "Neutral Tint" to Whiten it.

Area of the sunlight curve, 484·95; do. ethine curve, 559·50; do. gasoline curve, 422·00; do. gasoline whitened, 254·00.

location of the marked lines in the sun spectrum is given; and the spaces marked with the figures were obtained by the usual scale, and then developed to the arbitrary distance chosen for the projection. This gave the Y distances, the lengths of the parts of the spectrum. The ordinates of the curve were obtained by an arbitrary division of the scale of the interposing prisms; and as there is no possible natural scale, these X distances were projected also in millimetres. This system of projection divides the spectral curve into a series of 27 parts, whose relative areas can be determined with a certain accuracy.

The Curves Determined.—Up to the present, I am willing to publish my observations only on sunlight, the ethine (acetylene) flame, and the gasoline vapour argand, both in its natural condition and whitened by a neutral chimney. It is to be noted in passing that the combustion of the ethine is complete, and that of the gasoline very far indeed from this so desired condition; the fact being that, at the temperature of the Argand flame, there were present undecomposed hydrocarbons that were volatilized unchanged. Along with these others, series of observations were made on ordinary city gas; but variations of the parts of this spectrum are so lawless and erratic, that any attempt to show a normal curve would be misleading.

The Sunlight Curve.—If it were intended to express the value of the average illuminating power of the sun, the method of measure and delineation employed would be utterly foolish. But this was not the intention, but only to show what the sunlight might be taken to be in New York on an average day. The amount reflected from a square inch of glazed porcelain is the unit employed.

The Ethine (Acetylene) Curve.—This has a different value, and may be taken to represent, with a certain approach to accuracy, the comparative amounts of rays of every colour that come from the best luminous flame of ethine which I have been able to get. The flame was of as pure a quality as could be obtained from a commercial sample of calcium carbide, and contained no air, and only 3 per cent. of other gases. The tip used for the burner was a Bray, burning 1¼ cubic feet per hour; the pressure was 2 inches of water at the burner. The fact that the spectrum was so much more brilliant in the part between the lines D and G was verified by a direct comparison with the sunlight reflected from the white porcelain as stated. Repeated observations made since convince me that, under all ordinary atmospheric conditions in this city, it must be accepted as an observed fact that the luminosity of the ethine flame is at this part of the spectrum more intense than that of any reflection of the sun's direct light that the eye will bear. By this is intended any reflection at which it is possible to look, for the space of (say) three minutes by the watch, without pain.

Table Showing the Differential Areas in the Spectra of Sunlight, Ethine Flame, Gasoline Air-Gas Flame, and the Same Whitened.

	Sun-Light.	Ethine Flame.	Gasoline Air-Gas.	Gasoline Whitened.
0— 10	1·50	2·25	10·5	—
10— 20	5·00	6·75	12·5	—
20— 30	8·00	11·00	15·5	—
30— 40	11·00	15·50	20·0	2·0
40— 50	16·50	21·00	24·5	7·5
50— 60	26·00	29·00	30·5	15·5
60— 70	42·50	44·00	38·0	22·0
70— 80	59·70	58·50	45·0	25·0
80— 90	60·00	61·00	47·0	26·0
90—100	51·50	56·00	42·0	25·5
100—110	40·50	49·00	34·5	24·5
110—120	31·00	41·50	27·0	23·0
120—130	23·50	34·50	20·0	20·5
130—140	18·00	28·00	14·5	17·5
140—150	14·00	22·50	11·0	14·5
150—160	11·00	19·00	9·0	11·5
160—170	9·50	14·00	7·0	8·5
170—180	8·50	11·00	5·5	5·5
180—190	7·50	9·00	4·0	3·0
190—200	6·25	7·50	2·5	1·5
200—210	5·00	6·00	1·0	0·5
210—220	4·00	4·50	0·5	—
220—230	2·00	3·50	—	—
230—240	1·00	2·50	—	—
240—250	0·75	1·50	—	—
250—260	0·50	0·50	—	—
260—270	0·25	0·00	—	—
Total areas	464·95	559·50	422·0	254·0

The Two Gasoline Curves.—These seem to me specially interesting, as showing the fact that, under all circumstances, the habit of "whitening" a light, under the impression that the seeming intensity is a gain, is a "progression backwards." The great excess of the red in the gasoline is an apt illustration of the loss of light from hydrocarbons of low breaking temperature. The luminosity of a hydrocarbon flame is limited by that of the carbon at the temperature of disassociation.

Discussion of the Curves and of the Table.—In comparing the curves and their areas, it is to be remembered that the one given for the sunlight does not pretend to any definition of the

sun's luminosity, but only to set forth the extent of the sun's light as reflected from a square inch of glazed porcelain, which has been stated to be all that the eye was able to bear for three minutes without a sensation of "pain," by which is intended the warning that to gaze longer might cause discomfort of prolonged duration.

It was obvious that this light was less intense than that of the ethine flame which produced no analogous effect; and this appears to be caused by the predominance of the chemical rays in the sunlight, which, in the conditions of the experiment, were as 400 : 1, when compared to the ethine, as shown by exposure of sensitive films.

Curves traced for columns Nos. 3 and 4 are much more worthy of acceptance than those for columns Nos. 1 and 2, for the reason that the colour of the test light was the same as that of the gasoline air gas, and only a trifling difference could be observed even when the flame was whitened. Besides this, the number of observations made was numerous, and this is the mean; while of necessity the sunlight is a very variable quantity, and to obtain any rational curve, that of one series only could be used in plotting.

The Relation of the Curve Areas to the Candle Power.—It is naturally very pleasing to me as an observer to note that the gross observation of the candle power of the gasoline air-gas flame, 40-candle power, should come so near to the sum of the parts—422 mm. area—and that that of the whitened flame should be 254 mm. area for a candle power of 26. But, from the want of any obvious connection between them, this was judged to be a coincidence, until comparison of a large number of observations showed that the same ratio, or one strangely like it, ran through all the observations when they were reduced to the conditions needed for plotting. The condition that confronted me appeared to be this: If the momentum of the whole of the rays of light is nearly the same to within the perception of the human sight sense (and it is), it follows that there must be the same number of rays impinging on the area of the almost invisible violet as on the brightest yellow, if a small unit of area—say, a square millimetre—is taken, and *a fortiori* in the case of the slit of the spectroscope.

Therefore, if the instrument were well made, the opaque prism would be the most perfect of photometers; and there can be no harm, then, in the assumption that, within the conditions of this series of experiments, the sum of the differential parts divided by the unit lengths of the parts should be equal to the candle power. If this held good, the candle power of the ethine flame would be 60; and by observation made as well as possible under the conditions, it was 64-candle power. I do not know whence this large discrepancy comes; but I suspect it is an observation error due to the excessive brightness of the flame affecting the light-appreciation of the eye—a not unknown result in this department of study.

It would be a pleasure to compare these rather hurried observations with some made at leisure and when in the vein, as were those of the gasoline flame; but as the present interest in acetylene seems to warrant publication, they are offered—of course, subject to review when a greater opportunity shall have brought greater knowledge. Until then, I offer them as, so far as I know, the only study that has been made into this interesting question—the investigation, mensuration, and delineation of the comparative illuminating value of small homologous parts of the spectra of artificial illuminants, or into the light-values of that of ethine at all.

A STUDY OF NAPHTHALENE.

Under the title of "Naphthalene: The Causes of its Formation and Means for its Prevention in a Free State in Illuminating Gas," the following article, specially prepared for the "American Gaslight Journal" by Mr. C. P. Russell, appeared in a recent number of that publication:—

In subjecting coal to the process of dry distillation, as practised in the manufacture of illuminating gas, in addition to the coke and the incondensable gases which, after going through the various processes of purification, are sent into the holders, there are formed, through the various reactions between the disengaged principles of the coal, many other products, varying necessarily more or less in quantity and character, according to the quality and condition of the coal used, and with the divers circumstances under which distillation is carried on. Many of these newly-formed bodies—all being volatile—condense with tar.

The composition of this tar is, of course, subject to some variation, dependent upon the temperature under which the distillation of the coal is effected. Under the higher temperatures, the yield of solid bodies and gases will be greater; under low temperatures, the liquid portion of tar is appreciably increased in amount. In distilling the tar, we obtain varying proportions of a number of products, which may be classified in the three divisions of liquids, gases, and solids. I will here treat of the latter only, as in that division we find naphthalene, the subject of this article.

Naphthalene is a white, shining, crystalline substance, fusing at 176° Fahr., and boiling at 423° Fahr., but volatilizing when brought into contact with steam. It is not soluble in water, but readily dissolves in alcohol, chloroform, naphtha, ether, or carbon disulphide. Its presence in a free state in illuminating gas is very annoying, both to the producer and the consumer, and should be carefully guarded against. In the former case, it effectually blocks the passage of the gas from the generating apparatus to the holder; causing stoppages and back-pressure in the train of apparatus, and very often necessitating the complete closing down of the plant. Owing to its tendency to develop, particularly in cold weather, when perhaps the works are being pushed to their utmost capacity, the importance of detecting it and preventing its crystallization is evident. Aside from the disadvantages above enumerated, the candle power of the gas is materially reduced; and if the crystals form outside the works, in the distributing system of mains and service-pipes, we are confronted with a batch of complaints from our consumers that is certainly disheartening.

As soon as this annoying impurity (if I might so term it) gives evidence of its presence, the cause thereof should be immediately sought for and corrected. The condition of the coal should first be looked after. The use of wet coal—particularly if slack—should be avoided. This is probably one of the most fruitful sources of our trouble; and too much stress cannot be laid upon the necessity of keeping the heats in the retorts as nearly even as possible. Being convinced, from my experience with this troublesome substance, that its formation can be checked before the gas leaves the generating apparatus, I will state some reasons for my convictions.

In operating one of the plants of which I was in charge several years ago, we were suddenly called upon to supply a much larger quantity of gas than usual, owing to the electric light plant being shut down, and unable to furnish light. Our bench capacity was limited; and it became necessary to run much larger charges of coal per retort than had been our practice. Notwithstanding the facts that the duration of the charges was the same, that the heats were kept up to the usual degree, and that the charges when drawn were thoroughly burned out, we began to experience trouble from naphthalene. This seemed strange; and it caused me to closely investigate what occasioned the deposit. After a few days, the electric plant resumed operations, and we returned to our normal output. The quantity of coal charged per retort was reduced to what it previously had been; and no further deposits of naphthalene were then experienced. The weather conditions—temperature, barometric pressure, and precipitation—were practically the same during the period of my observations. This proved to me conclusively that, although the outward indications showed the process of distillation to have been regular in both the light and heavy charges of coal, the resultant gas did not leave the mouthpiece in as perfectly fixed a state when the heavy charges of coal were carbonized. I therefore believe that if, in carbonizing the coal, the weights are so fixed that the travel of the gases resulting from its distillation will be gradual through the retorts, giving them time to remain subjected to the full action of the heat, the hydrocarbons will be so thoroughly fixed that there will be little or no danger of naphthalene deposits.

The argument may be advanced that this method of operating would necessitate an augmentation of the number of benches under fire, and a consequent increase in the cost of production. This is in a measure true; but I am satisfied that, if the additional amount thus expended is compared with the loss incident to stoppages in the works and the reduction in consumption should such stoppages occur in the mains and services, the balance will be decidedly in favour of additional benches.

Assuming that works are handicapped in the matter of bench capacity, and that the generating apparatus is being operated to its utmost, one must look to other methods than the foregoing to overcome the troubles. This may be done effectually in the condensing apparatus; and by carefully and systematically noting and recording the conditions, any serious trouble from naphthalene deposits can be avoided. The writer was located at a point where extreme temperature conditions are frequently encountered. Sudden changes were the rule rather than the exception—the thermometer often falling 20° in as many minutes. Bench capacity was at a premium; and the demand for gas was generally upwards in proportion to the downward tendency of the mercury. Consequently, the condensing apparatus was frequently called upon to do the work that I would have much preferred to spare it if additional retorts had been available.

In operating the benches, when the retorts were in action, the use of the dip-pipe in the hydraulic main was dispensed with. The gas was taken directly from the retorts through a bye-pass arrangement clamped to the bridge-pipe, and flanged to the top of the hydraulic main, worked by a system of levers from the retort-house floor. This brought the gas to the exhauster at a temperature ranging between 110° and 120° Fahr. The exhauster was speeded up by means of a connecting-pipe with a check-valve conveniently located, so as to cause the gas to be returned from the outlet to the inlet of the exhauster as many times as possible without affecting the pressure on the retorts. This pressure was maintained at 5-10ths. The gas, being made to come in contact with the blades of the exhauster more freely and under higher speed than is usually the practice, was deprived of a large quantity of its tar and heavy hydrocarbons, and was in a condition, on leaving the exhauster, to be effectually treated by the condenser, and freed of all the remaining tar. The condenser was of the Pelouze and Audouin type, and was

placed immediately after the exhauster. The gas at the inlet test-cock showed a decided "tar stain." The counterweights on the invert were adjusted to operate the machinery under a differential pressure of 20-10ths, which by experience I believe to be the most successful practice. The gas at the inlet showed an average temperature of 110° Fahr. The test-cock on the outlet proved the gas to have been entirely stripped of its heavy tar, and showed only a light vapour stain on the test-paper. The thermometer indicated a drop of about 5° Fahr. as a result of the mechanical condensation. From the Pelouze and Audouin condenser, the gas entered a washer, the interior arrangement of which was a series of vertical, corrugated, perforated plates, so constructed that the perforations were diagonally opposite, and the corrugations overhung each other in such manner as to receive the drippings from the liquor feed-pipe, and present a constantly wetted surface to the gas in its serpentine passage through the apparatus. The inlet to this washer was similar to the ordinary dip-pipe, submerged in the liquor drained off the plates; the dip being adjusted to work the apparatus under a differential pressure of 25-10ths. On leaving the washer, the gas was subjected to thorough desiccation in a dry lime purifier, which I may here state I believe to be the most efficient means of arresting the formation of any naphthalene crystals. Beyond this point, I never found any indication of naphthalene; and I am positive that the same satisfactory result will be obtained wherever this practice is followed. The scrubber came next in order; then the multitubular condenser, the purifiers, the station meter, and the holders. Opinions differ as to the proper arrangement of the apparatus. The one I have outlined is, I know, somewhat of a departure from the ordinary; but my results were so satisfactory to the stockholders, consumers, and myself, that it would take some very convincing arguments, backed up by corroborative figures, to assure me that any improvement could be made.

Before concluding this article, it would perhaps not be amiss to give a few simple and effective tests whereby the presence of naphthalene may be detected when not apparent to the eye in the form of crystals. The liquor from the hydraulic main, condensers, or scrubbers, when reddened by a solution of nitric acid, supersaturated with muriatic acid, will show the presence of naphthalene by tingeing a strip of fir wood a rich purple colour. Another test is to neutralize the liquor with dilute sulphuric acid. If naphthalene is present, the liquor assumes a rose colour; and the sulphate solution gives off the peculiar odour distinctly characteristic of naphthalene.

These remarks apply to water gas as well as coal gas, whether the process is of the straight generator type or whether the carburetting is done in fixing-benches. Overtaxing any type of generating apparatus will be equally prolific in causing naphthalene deposits; and if the gas is allowed to get away in an imperfectly fixed state, we may expect trouble either round the works or in our main and service-pipes. The results given in the article are those obtained in actual practice, and are not based solely upon theory. The remedies are simple and comparatively inexpensive; and if the suggestions made are followed out, every claim will be freely and satisfactorily substantiated.

DETERMINING THE EFFECTIVE CENTRE OF THE LIGHT EMITTED FROM A STANDARD PHOTOMETRIC BURNER.

At the December Meeting of the American Society of Mechanical Engineers, the following paper, dealing with the above subject, was presented by Professor D. S. Jacobus. Our readers may remember that the author read before the same Society, about three years ago, an elaborate paper on "The Experimental Determination of the Heat Generated per Candle Power by Gas and Oil Lamps," which was reproduced in the "Journal" at the time (see Vol. LXI., pp. 55, 98).

In tests of car-lamps made by the Department of Tests of the Stevens Institute during the past spring and summer, it was necessary to employ a burner of about 6-candle power as a standard of light. The burner selected was a Sugg argand, size D, fitted with an opaque screen, which passed over a glass chimney. The opening for the emission of light was arranged so that the top and the lower part of the flame were obscured from view, as shown in fig. 1; whereas the horizontal width of the slot was made greater than the diameter of the flame. The horizontal width A B of the slot was $1\frac{1}{2}$ inches, and its height C D was $\frac{13}{16}$ inch. The diameter of the opaque screen was $1\frac{7}{16}$ inches. The back of the screen opposite the slot was cut away so as to prevent reflected light from being thrown back and through the slot.

In this class of screen and burner, the distances employed in calculating candle-power measurements are often measured to the geometrical centre of the flame. Any error so involved will be a small one, if the illuminated disc of the photometer is used at a considerable distance from the burner, and in about the same position which it occupied when the burner was calibrated by means of candles. In our tests, however, the burner had to be used in positions near to, as well as far away from, the disc; so that it was necessary to determine the effective centre of the light emitted.

The method of determining this centre was as follows: The photometer disc was set at A (fig. 2) at a distance c_1 from the candles C, and the standard burner was brought to a position B_1 at which there was an equal illumination on the two sides of the photometer disc at A_1. The distance b_1 from the disc to the geometrical centre of the burner was then recorded. The disc was afterwards moved to another position A_2, at the distance c_2 from the candles; and the corresponding distance b_2 from the disc to the burner was recorded. The disc was then set

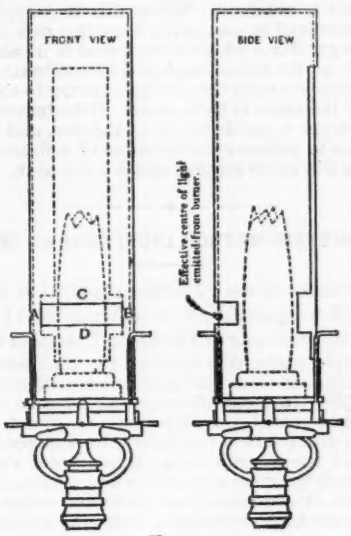


FIG. 1.

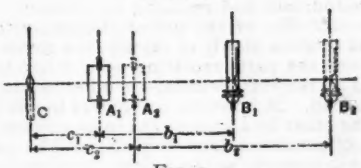


FIG. 2.

back to its first position at A_1, and a second reading of b_1 obtained. It was then moved to A_2, and then back to A_1; and so on, until a number of readings of b_1 and b_2 were obtained. After a sufficient number were taken to eliminate any irregularity due to variations of light emitted from the candles, the results were averaged; and the distance x of the effective light-centre from the geometrical centre of the flame was found by means of the formula—

$$x = b_1 - \frac{b_2 - b_1}{\frac{c_2}{c_1} - 1}$$

The results of the experiments are given in the table, and show that the effective light-centre of the burner was about 0·9 inch from the geometrical centre of the flame, and entirely outside the flame, as indicated in fig. 1.

Results of Tests to Determine the Distance from the Geometrical Centre of a Standard Photometric Burner to the Effective Centre of the Light which it Emits.

Date, 1895.	Number of Sets of Readings Averaged.	Distances from Candles to Photometer Disc, in Inches.		Average Distances from Photometer Disc to Burner, in Inches.		Distance from Geometrical Centre of Flame to Effective Light Centre to Burner = x.
		c_1.	c_2.	b_1.	b_2.	
May 11	21	10	15·0	19·44	28·70	0·92
,, 24	15	10	15·0	18·77	27·71	0·89
,, 24	9	7	14·0	12·95	25·00	0·90
,, 24	9	9	13·5	16·76	24·70	0·88
,, 28	30	10	15·0	18·44	27·82	0·88
					Average	0·89

The candles do not have to be corrected for variations in the rate at which the paraffin is burned. All that is necessary to ensure accuracy is to make a number of observations, changing the distance of the photometer disc from the candles each time a reading is taken, as has already been explained, and employing the average figures in the formula. When this is done, any variation of the light emitted by the candles during the test will affect the average values of b_1 and b_2 in such a way as not to alter the value of x.

The error involved, if all measurements were made from the axis of the burner instead of the effective centre, both in calibrating and in using the standard burner, would have been, as a maximum, about 10 per cent. in the lamp tests which we made. In these the effective centre of the burner was placed at a distance of 60 inches from two standard candles in calibrating the burner; and the minimum distance at which the burner, when used as a standard, was placed from the photometer disc, was about 12 inches.

An ordinary way of using the burner is to place it 60 inches from two standard candles to calibrate it, and then set it 60 inches from the flame of which the candle power is to be determined—all distances being measured from the axis of the burner. If calibrated and used in this way, there is an error of about 3¾ per cent. for a flame of 20-candle power, and of about 6 per cent. for a flame of 40-candle power.

Another way in which the burner is calibrated is to measure the candle power of a uniform gas-flame first with candles and then with the burner; and repeat the two operations until an average figure is obtained. When this is done, there is but a small error involved in measuring from the axis of the burner, provided the gas-flame which is measured is of about the same candle power as the flame employed for calibrating the burner, so that the distance from the standard burner to the photometer disc is about the same in both cases. If the burner is calibrated at 60 inches from a gas-flame of 24 candles, and is used at the same distance to measure the intensity of a flame of 16-candle power, there will be an error of about 1 per cent.

A PHOTOMETRIC METHOD INDEPENDENT OF COLOUR.

A recent number of the "American Journal of Science" contained the following article on the above subject by Mr. Ogden N. Rood, A.M., Professor of Physics in Columbia College:—

The principle underlying most of the photometric methods now in use depends on a comparison of the illumination of two adjacent fields. In some instances, as where a spot or a ring is made to disappear, this idea is thinly disguised, but instantly becomes apparent when the lights are differently coloured. The object of the present paper is to present a mode of procedure in which the coloration of the two surfaces, even though at a maximum of vividness, is a matter of entire indifference, since the process depends not on a comparison of these surfaces, but on the shock which the retina experiences when one surface is quickly withdrawn and replaced by another. If we take a uniform circular disc of any colour, illuminate it evenly, and then set it in rotation slowly or rapidly, the retina will receive no shock, since the parts replacing each other in the retinal image are in all respects identical—in other words, no flickering will be perceived. If, however, one half of the disc reflects less light than the other by 1-50th of the total amount, with appropriate rates of rotation a faint flickering will be noticed, which will increase in intensity as the difference of the luminosities of the two halves of the disc is made greater.

Accordingly, I prepared a set of about a hundred discs of drawing-paper, their depth of tint ranging from the whitest white paper down to the blackest; the gradation being as even as practicable. For the determination then of the reflecting power, for example, of a vermilion disc, it was only necessary to select from the series a grey disc, which, when combined with it in equal parts, gave no perceptible flicker, and afterwards to determine the reflecting power of this grey disc in terms of the standard white cardboard. Results were thus obtained for the principal colours, red and blue-green, yellow and blue, green and purple. The difficulty in measuring the reflecting power of these coloured discs was in all cases the same, and was due to the fact that it is hard to obtain grey discs with absolutely uniform surfaces. This trouble, or lack of uniformity in the coloured discs themselves, was to a considerable extent obviated by reversing the halves of the composite disc so as to employ the previously unused surfaces. Small irregularities, texture, or a sandy appearance, do not interfere with the use of the discs to a noticeable extent; but when the depth of the tint changes slowly over an extended surface, it gives more trouble.

Of course, the case frequently arose where, in the entire hundred discs, not one could be found with which the flickering wholly disappeared with quite low rates of rotation; and here it was necessary to determine with which grey disc the flicker was at a minimum. This was accomplished by combining the same coloured disc with two grey discs—a larger and a smaller—on the same axis, when it would become evident which was the more favourable combination; and the observer would notice that the luminosity of the coloured disc must be nearer to one grey disc than to its mate, or about equally distant from both.

As before stated, results were obtained for six discs; but these were selected so as to be complementary to each other in pairs. In order to test the process, they were now combined pair-wise; and the resultant luminosities of their grey mixtures were determined by the old method, and afterwards calculated on the basis of the figures furnished by the flickering process:—

Purple and green	Observed	27·5
	Calculated	27·5
	Difference	nil.
Red and blue-green	Observed	20·2
	Calculated	21·1
	Difference	0·9
Yellow and blue	Observed	27·85
	Calculated	29·10
	Difference	1·25

These experiments were not at all elaborate; and as their greatest difference barely exceeds 1 per cent. of the reflecting power of white cardboard, they may be taken as furnishing a proof of the correctness of the process employed.

Thus far I have dealt with the combination of white (grey) discs with those that are strongly coloured. It remains to give an example of the process as applied to two differently coloured but not complementary discs. To test this matter, it was necessary to find two coloured discs having the same, or nearly the same, reflecting power. In my collection, I finally found two such discs—a cyan-blue with a reflecting power of 23·9, and a purple for which the figure 23·3 had been obtained. These discs, when combined, gave a scarcely perceptible flicker. Since then graded series of yellow discs have been made; but it has been impossible to find time to look up their equivalents in luminosity, and make the necessary determinations.

This flickering process having answered so well, the procedure was reversed, and used with great advantage to facilitate the determinations of the values of the grey discs executed in the ordinary way; in other words, the series of grey discs as made by myself are not pure grey, but have a slightly yellowish tint that makes estimation on equality of luminosity a little more difficult than it ought to be. Accordingly, in measuring the reflecting power of the grey discs by the old method, the standard white and black discs were combined with a small amount of an orange-yellow disc, which made their mixture match the tint of the grey disc under experiment. The luminosity of the orange-yellow disc in terms of standard white cardboard being known, the final result was calculated with equal facility, and the annoyance removed. It is hardly necessary to add that in all cases the amount of white light reflected from the standard black disc was taken into account.

An experiment was now made to test the flicker process by using it to determine the reflecting power of two grey discs, which were afterwards measured in the ordinary way; and the following result was obtained:—

Direct determination	34·1	..	29·1
Flicker "	33·7	..	28·6
Difference	0·4	..	0·5

These determinations were not elaborate, but they may suffice for the purpose.

Afterwards a more careful set of observations was made to ascertain with what minimum difference in luminosity the flicker became insensible. A series of five light-grey discs was made with gradations so small that these would have required elaborate work for their individual determination. This was not attempted directly; the method of measuring the least and the most luminous discs being employed, and the difference between the figures divided by four. When these discs were tested flicker-fashion in pairs, it was found that the intervals between them were not at all identical—one being larger and its neighbour smaller than the average interval; but each pair nevertheless furnished a faint but distinct flicker. If the intervals had been regular, as was intended, the experiments would have proved that, with a difference of 1-50th part of the total light, a flicker could be perceived. As it was, it showed that a much smaller difference suffices, probably about 1-100th.

It is evident that, for the purpose of measuring the reflecting power of coloured discs, it will not in every case be necessary to undergo the labour of making an elaborate set of grey discs. If the experimenter is furnished with six or eight brilliantly coloured discs, the reflecting power of which has been carefully determined, then, with these and black and white discs, he will be able to match new discs, and measure their luminosity in the old way.

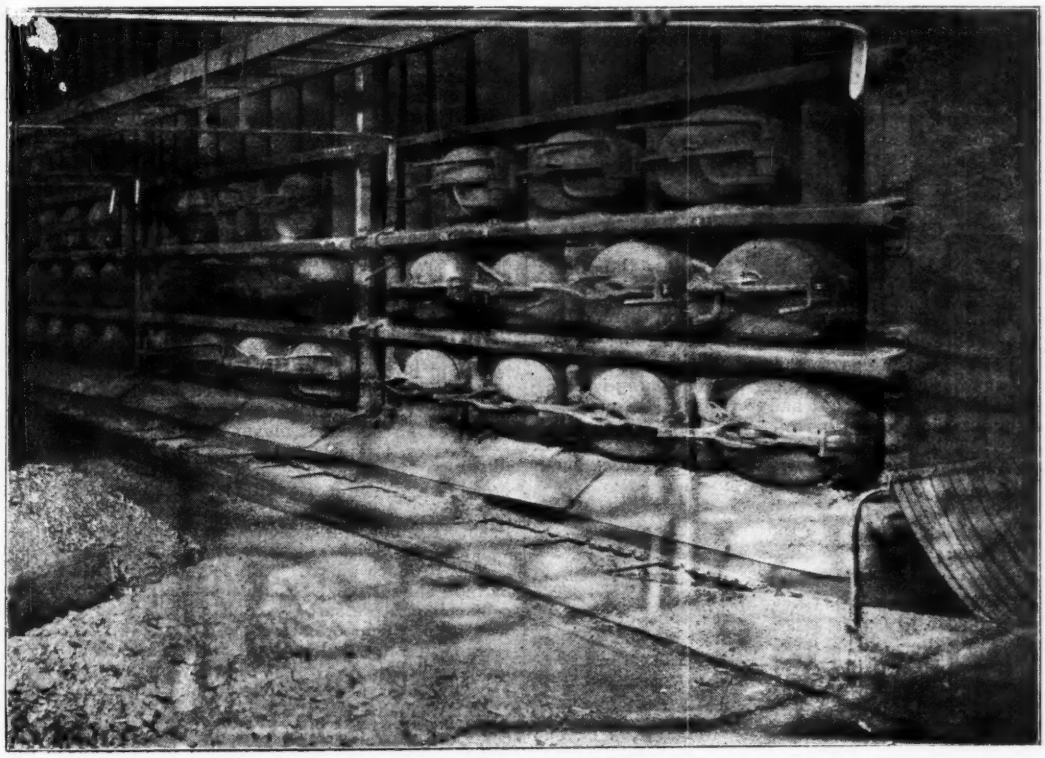
There does not seem to be any reason why this process, with the aid of well-known optical devices, should not be applied to ordinary photometric work, or to such as is carried on in the interior of the observing telescope of a spectroscope. In simple work, with discs like that here described, the flicker photometer is necessarily on the model of a staircase; and the transitions, though small, are always abrupt. But when there are other modes of regulating the illumination, this would not be the case; and the advantage of multiplying observations would be more fully experienced. Some experiments for dividing up even the interval between two discs have been begun, with promising results.

It is well known that gazing steadily at a flickering surface is trying to the eyes; but in the operations above described, no inconvenience whatever from this source was experienced, since, if the flicker was strong, a glance revealed the fact, and another disc was substituted. The faint flickering which demands more prolonged attention seems to be no more trying to the eyes than ordinary optical work.

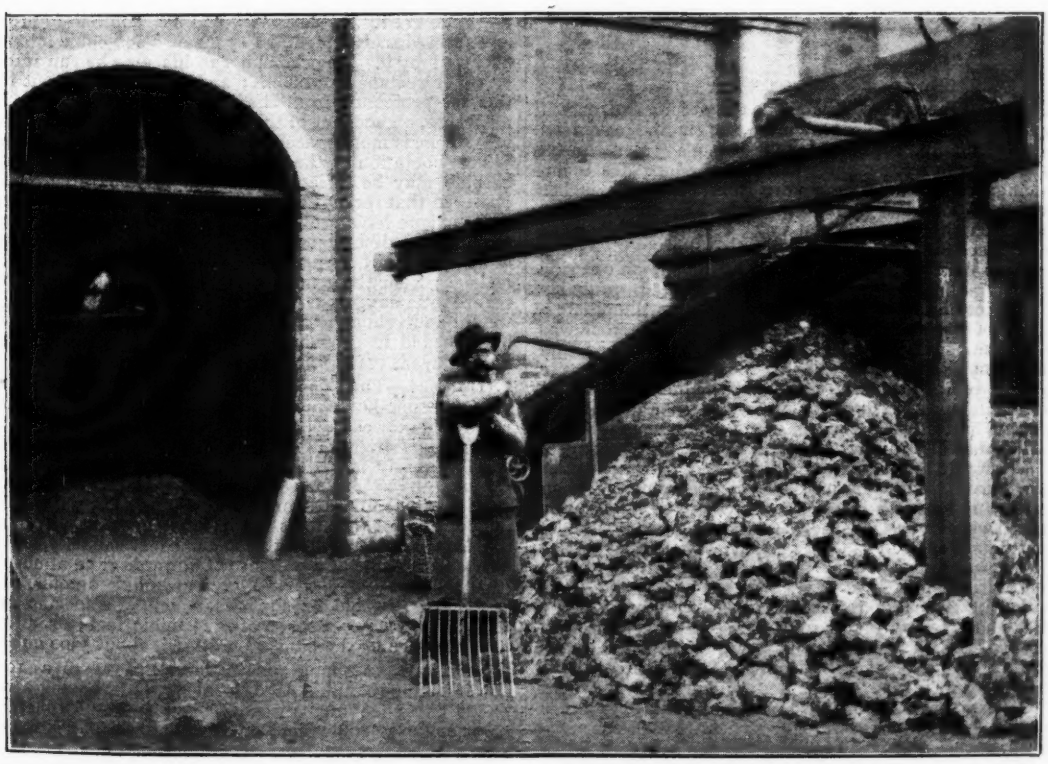
It may be matter of some interest in physiological optics to know that the sensation called "flickering" is independent of wave-length, and connected with change in luminosity. When two differently coloured surfaces of the same luminosity are successively presented to the eye as above described, no shock is experienced, and the colours are seen to mingle in a soft streaky way. If observation is prolonged for some time, subjective effects begin to manifest themselves, especially with quite low rates of rotation. It is, of course, best not to study these with undue curiosity.

M. DE BROUWER'S MECHANICAL COKE QUENCHER AND CONVEYOR.

The mechanical conveyance of coke from the retort-house to the yard has occupied the attention of not a few gas managers in England and upon the Continent. Among others who have studied this problem with the view of finding a practical solution to it, is M. de Brouwer, the Manager of the Bruges Gas-Works. Many of our readers may possibly have noticed, in the list of applications for patents which appeared in the "JOURNAL" for the 24th ult., one by M. de Brouwer for mechanism for "conveying incandescent coke from retorts in gas-works, extinguishing same during its passage along the apparatus, and screening the coke, and piling up, storing, or discharging it into waggons or other receptacles." The character of the arrangement and its application are well shown in the accompanying illustrations. It will be seen that, instead of the hot coke drawn from the retorts being loaded into barrows and wheeled into the yard to be quenched, or damped on the retort-house floor and then carried away—in either case being handled two or three times—it is made to fall into a water-tight channel, and then conveyed outside the house by a system of endless chains and cross-bars somewhat resembling a ladder. The channel is, of course, a fixture; the chain ladder only being carried by wheels. Working smoothly and noiselessly along the entire front of the retort-bench, the ladder conveys forward the whole of the coke, which is partially quenched by jets of water running into the channel at various places—at once facilitating the process of removal



DE BROUWER'S COKE QUENCHER AND CONVEYOR, APPLIED TO A SET OF GENERATOR-HEATED RETORTS.



DE BROUWER'S COKE QUENCHER AND CONVEYOR PILING UP COKE IN YARD,

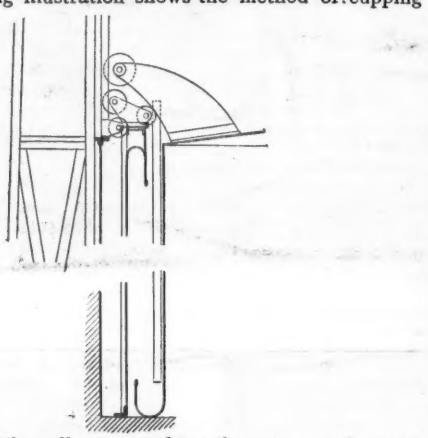
and keeping the mechanism cool. It will be noticed that, outside the retort-house, the channel is made to rise at an angle of about 30 degrees. It can be raised to any height, and continued in any direction, and to any distance; so that the coke may be carried to a breaking and trimming machine, to railway trucks, or to the stack in the yard. This raising of the coke by the elevation of the channel is a special feature of the installation, as it is a rather unusual method of effecting thorough, but by no means excessive, wetting. The lumps, in their progress through the channel, sweep forward the water contained in it; and when the ascent of the incline is commenced, the water, not being taken hold of by the bars of the ladder, flows through the coke, and damps it sufficiently.

Several advantages are claimed by M. de Brouwer for his arrangement. In the first place, he says it effects an economy of about 33 per cent. in the labour required in the retort-house. But beyond this there is with it a considerable lightening of the usual work of the stokers. The duties are less trying to the constitution; the bodies of the men not being exposed to sudden changes from the intense heat of the retort-house to the variable weather—cold, windy, or wet—prevailing outside. Besides the saving in labour and wages, economy results from the coke not being uselessly burnt in the barrows, on the retort-house floor, or in the yard; while, owing to less handling, a much smaller quantity of breeze and dust is necessarily produced.

A GASHOLDER IN FLAMES.

We have received from Herre Hj. Samzelius, the Chief Engineer of the gas-works at Gothenburg, Sweden, a report on an accident to a gasholder which has occurred there. The following is an abbreviated translation of the document:—

On the 4th of December, one of the two holders at the Gothenburg works was destroyed by escaping gas becoming ignited. The holder was erected in 1894, and had two lifts; giving a storage capacity of about 460,000 cubic feet. The height of each lift was 20 ft. 4 in.; while the diameters were 126 ft. and 123 ft. 4 in. The accompanying illustration shows the method of cupping



and guiding. All the rollers were above the water; and, except that they were radial instead of tangential, the guiding resembled that described on pp. 207-8 of Dr. Schilling's "Neuerungen auf dem Gebiete der Erzeugung und Verwendung des Steinkohlenleuchtgases." The rollers were from 2·8 to 3·5 inches wide, and ran in grooves 5·3 inches wide. The holder was at its full height on the above-named date; and the heat of the sun forced out some gas at the lower edge, until at midday large quantities were observed to be escaping at the cup on one side of the holder. Shortly afterwards, the gas ignited—probably from the pilot-jet of a lamp fixed on the crown to illuminate a scale on one of the standards, by which means the stock was measured. The Fire Brigade was summoned; but it was found impossible to make good the seal, and the flames quickly rose above the roof and columns and girders of the holder for about half its circumference. The flood of fire lasted about fifteen minutes, when, half the gas being consumed, the inner lift sealed itself in the tank. In the meantime, however, the riveting of the bell had become loosened by the heat; and great quantities of gas were burning at the gaping seams between the plates on the side of the upper lift and on the crown. The holder was well sprinkled with water. But the gas was continually re-ignited by adjacent flames as soon as extinguished; and an hour passed before the fire was quite subdued. The holder was immediately thrown out of use.

The outer lift appeared to have escaped damage; but the plates of the crown had either suffered by direct contact with the flames, or had bent and buckled from the expansion of the others. About two-thirds of the side plates of the inner lift were similarly damaged. The outer guide-rails were bent where they had become heated; and probably the inner grooved rails also had suffered. The struts of the crown were found to have curved spirally round their central post, owing probably to pressure brought about by the contraction, when the heating ceased, of the angle-iron stiffening the curb of the lift. Some of the columns and girders of the framing were also twisted. The fire was in all probability due to the tilting of the bell causing an insufficient seal.

As might be expected with a holder of such proportions, having all the rollers above the water, slight tilting had been at times observed; but it was not so great as to cause apprehension. The deflections were smaller the higher the holder was, as the guide-rollers had more effect when it was well up. Once, however, when the outer lift protruded only one yard above the rim of the tank, and was consequently feebly guided, considerable tilting occurred; and there was a difference in the height of the two sides of 16 inches—gas escaping from the cup. The guide-rollers were then nicely adjusted to give not more than $1\frac{3}{16}$ inches play radially; and the tilt of the bell has since been daily measured in the cup, and there has been no indication of danger. An hour before the fire, there was a tilt of $7\frac{1}{2}$ inches; and the cup was full of water. The inclination, which at the very worst was 1:100, was never observable by bystanders. There was not a strong wind at the time of the occurrence; and the rollers did not appear to have shifted when examined afterwards. In repairing the holder, the outer lift will have to be provided with bottom rollers, to make the guiding of it more perfect.

ACETYLENE FOR DRIVING GAS-ENGINES.

The use of acetylene for the production of power has been suggested several times since it has become a commercial product; but Dr. A. Frank, of Charlottenburg, has stated its advantages and disadvantages for the purpose very explicitly in the "Journal für Gasbeleuchtung." Calcium carbide, capable of yielding 90 per cent. of the theoretical amount of acetylene which the pure carbide should give, is now obtainable from the works at Bitterfeld; and a very good article is also now made at Neuhausen. Dr. Frank suggests that the carbide furnishes an excellent means of transporting power (derived from water, for instance) to a distance from the source. He considers Herr Ihering's proposal to compress acetylene to a liquid at a pressure of 50 atmospheres for transportation a less practicable one than that of conveying the calcium carbide itself. He bases this conclusion on the following figures: 64 parts (by weight) of calcium carbide on addition of water should produce 26 parts of acetylene; or 100 lbs. of calcium carbide should yield 40·62 lbs. of acetylene = 559 cubic feet at atmospheric pressure. The liquefied compressed acetylene weighs 28·15 lbs. per cubic foot, or 40·62 lbs. occupies 1·443 cubic feet; while the calcium carbide necessary to produce this quantity will have a volume of only 0·722 cubic foot, taking its specific gravity at 2·22. The volume of the calcium carbide is therefore about half that of the acetylene gas it would yield, when the latter is stored as a liquid under a pressure of 50 atmospheres. The space occupied by the walls of the containing vessel is, moreover, unconsidered in this comparison of volume. But the commercial production of acetylene from the carbide only gives 90 per cent. of the theoretical yield; and therefore 111 lbs. of carbide would be required to produce the 40·62 lbs. of acetylene, and a space of 0·800 cubic foot would be occupied by it. The calcium carbide may be run into cubical or other rectangular blocks; and these may be put into light tins for protection from the air and moisture. The liquefied acetylene, on account of the weight and shape of the containing vessel, needs more space than the carbide for its storage.

The liberation of the acetylene from the roughly-powdered carbide may be effected with simple apparatus. It may be observed that recent experiments show that the toxic properties of acetylene have been much overrated. Small mammals can remain for half an hour in an atmosphere containing 4 per cent. of acetylene without perceptibly suffering inconvenience. Slight leakages from the generating apparatus need not, therefore, be regarded as dangerous to the workmen. If a comparison of the weight and volume of coal, liquefied acetylene, and calcium carbide needed to provide power for a 1000-horse marine engine for 25 days is made, the following are the results:—

(1) *Coal.*—The 600,000 horse-power-hours will need, at 1·543 lbs. per horse-power-hour, 413 tons of coal, occupying, when well stowed, a space of 14,800 to 15,200 cubic feet.

(2) *Liquid Acetylene.*—According to Ihering and Slaby's figures, 0·4 lb. nearly is required per horse-power-hour with large engines, or 106 tons for 600,000 horse-power-hours. A specific gravity of ·451 at 0° C. corresponds to ·364 at 35·8° C. (about the temperature of the ship's hold); and therefore 106 tons would require vessels of 9500 to 10,600 cubic feet capacity, and these to be absolutely safe at a pressure of upwards of 50 atmospheres.

(3) *Calcium Carbide.*—The corresponding amount of 90 per cent. carbide would be 295 tons, which, at a specific gravity of 2·22, would occupy a space of 4625 cubic feet; or, allowing for the tins in which the blocks are stored, about 5300 cubic feet.

Therefore, to supply power for 25 days to a 1000-horse power engine requires: Good coal, 413 tons, having a volume of 14,800 cubic feet; compressed acetylene, 106 tons, having a volume of 9890 cubic feet; or calcium carbide, 295 tons, having a volume of 4770 cubic feet. Moreover, coal needs a boiler, which is expensive both in first cost and in maintenance; while liquid acetylene requires large storage vessels, whereas simple

apparatus only is needed with the carbide. To one unversed in shipbuilding, it seems that, in the endeavour to find a very concentrated form of fuel to fit war vessels for long journeys, calcium carbide must attract attention. Stationary and locomotive engines on land might also use it, and be independent of foreign petroleum, which has lately also been much used for ships' boilers.

[Dr. Frank has unfortunately omitted to make the comparison between petroleum and calcium carbide as portable fuels. At a rough computation, petroleum burnt as fuel under a boiler should need only three-fifths the storage room of coal for the same duty; and whatever further advantage calcium carbide has in point of compactness is mainly due to the superior efficiency of the gas-engine to the steam-engine. The heavy duty on petroleum in Germany perhaps accounts for Dr. Frank's omission to give a precise comparison of its value as a fuel with coal and acetylene.—Ed. J. G. L.]

PAINT AS A PRESERVATIVE OF IRON.

The subject of the preservation of ironwork by paint, which has lately been dealt with in the "Journal," recently came before the Engineers' Club of Philadelphia, in a paper contributed by Messrs. E. A. Custer and F. P. Smith. It was in substance as follows:—

Experiments have demonstrated that bright iron does not rust when exposed to a dry atmosphere of pure oxygen and carbonic acid gas, separate or mixed. After the rust has once commenced, only the slightest trace of moisture is necessary to continue this chemical action, which is probably due not only to the corroding influence of the rust already present, but also to its power of absorbing oxygen and condensing moisture. Any covering that is absolutely impervious to moisture will, when applied to clean iron, prevent rust under atmospheric conditions in which corrosive elements are wanting. The protective covering that is to meet these conditions must be cheap and easily applied; and a paint or combination of paints seems to be the logical outcome of the problem involved.

The requisites of a good paint for the preservation of iron and steel are stated by Mr. Woodruff Jones to be these: (1) It should firmly adhere to the surface, and not chip or peel off. (2) It must not corrode the iron, otherwise the remedy may only aggravate the disease. (3) It must form a surface hard enough to resist frictional influences, yet elastic enough to conform to the expansion and contraction of the metal by heat and cold. (4) It must be impervious to, and unaffected by, moisture and atmospheric and other influences to which it may be exposed.

In undertaking to produce a paint with the above requirements that would absolutely protect iron, it was early determined that the covering should consist of two distinct elements, the first of which should possess the adhesive and elastic properties, and afford a safe and elastic base for the application of a second coating that would be hard, elastic, acid proof, and absolutely impervious to moisture. There is no paint known that will meet the first requirement so fully as good red lead and linseed oil. The dry film of red lead and linseed oil, however, is porous; and this defect must be remedied by a second coating of paint, which will dry with an absolutely impervious and waterproof surface.

It has been justly claimed for red lead that the property it possesses of saponifying the oil—not oxidizing it, in its true sense—renders it one of the most valuable pigments for a first coating on structural iron. After numerous experiments, a vehicle was finally selected as affording the nearest approach to an ideal covering for ironwork. The pigment was next considered, and it was decided that this must itself be inert so far as iron is concerned; for while it was intended to be used over a foundation coat of red lead, it should be possible to employ it in some cases as a sole protective covering. A material was incorporated in the pigment which enables it to resist frictional action in the highest degree, and makes it practically impossible to destroy and, to all intents and purposes, absolutely insoluble in any of the known solvents.

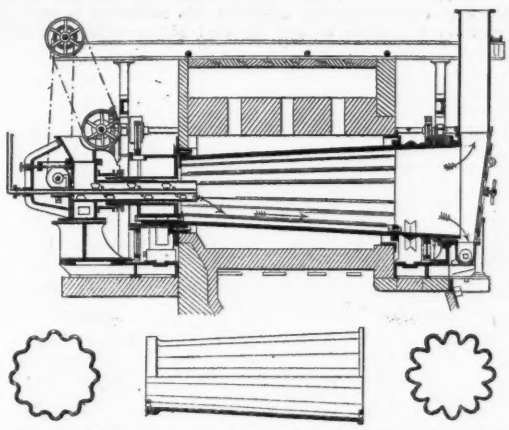
One important point that must be carefully considered when the protection of iron is desired is the presence of mill scale or iron rust. No paint, however good, is worth anything for the protection of iron when used over mill scale. The absolute removal of mill scale from the iron before it is painted should therefore be specified and insisted upon. In ordinary practice, it has been found sufficient to brush the surface of the iron carefully and thoroughly with a good wire brush, and then apply the paint.

Attention was called to the quality of the paint to firmly adhere to the surface of iron when subjected to very high or low temperatures; and some specimens of pipe were exhibited that were first coated when cold with the protective paint referred to, then subjected to live steam at a temperature of 340°, then painted while hot with the same preparation, and afterwards dipped in a mixture of ice and salt until thoroughly chilled.

REGISTER OF PATENTS.

Revolving Gas-Retorts.—Yeadon, J. A., and Adgie, W., of Leeds. No. 104; Jan. 2, 1895.

The patentees now propose to use a corrugated body for their revolving retort (as described in patents No. 19,183 of 1889 and No. 5239 of 1892), instead of fitting it up with internal blades or vanes, for the purpose of constantly turning over and breaking up the coal or other material during its passage through the retort. The patentees find in working that the use of the internal blades has a tendency to warp or crack the shell of the retort, in consequence of unequal expansion and contraction caused by want of uniform thickness throughout. They also find that, in the carbonization or revivification of different materials, the action of the blades causes the finer portions of the materials to pass up the ascension-pipe in fine dust; thus tending to choke the hydraulic main and other pipe-connections.



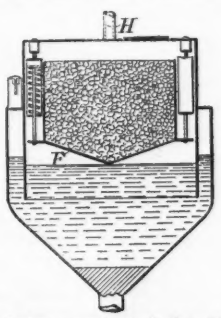
The bodies of the retorts are preferably made of conical or tapering form, as shown in the illustration; but they may be parallel, or any other form found most desirable. They are of an even (or nearly even) thickness throughout in the shell, for the threefold purpose of securing greater strength in their suspended working over the fire, increased area of internal conductive heating surface, and reducing to a minimum any warping or twisting of the bodies from unequal expansion and contraction.

The illustration shows the complete arrangement; also a detached conical and corrugated retort, and two different forms of corrugation. The corrugations turn over, and break up, the materials inside the retort; while, by the conical or tapering form of the body, the materials are worked automatically and continuously through the retort. When using bodies of conical or tapering form, the corrugations are longitudinal—*i.e.*, running in straight lines from end to end. When using bodies of a parallel form, the corrugations can either be made longitudinal, and the feeding end of the retort higher than the discharging end, or of spiral form (like an Archimedian screw); the pitch and number of the corrugations being suited to the number of revolutions of the retort and the time required for the materials passing through it.

Generating Acetylene Gas.—Morison, D. B., of Hartlepool. No. 2437; Feb. 4, 1895.

This invention has reference to generating acetylene from water and carbide of calcium in a vessel so arranged that, when there is a sufficient pressure of gas, it will prevent contact of the water with the carbide, and consequent generation of gas, until a reduction of pressure occurs.

Within a vessel adapted to hold water, there dips a second smaller vessel open at the bottom and closed at the top; the annular space between being open at the bottom to the main vessel. Within the inner vessel there is suspended, by springs (or it might be by compensating weights), provided with adjusting screws, a carbide supporter or



carrier, represented as being a perforated plate F (or a grating) adapted to support a block of carbide of calcium. The carbide supporter is of inverted conical form, so that the area of contact between water and carbide may be gradually increased or diminished. An outlet H for gas is provided at the upper part of the inner vessel, leading direct to the burners, or through a controlling governor as desired. The vessels are charged with water to a level above that of the perforated plate F; and thus the water will be in contact with the carbide, and gas will be generated. But when, owing to accumulation of gas, the pressure has increased to the desired limit, it will have depressed the level of the water within the inner vessel to a point below the bottom of the carbide, proportionally raising the level in the annular space between

the two vessels. Thus, while the desired pressure obtains within the upper portion of the inner vessel, no further generation of gas will take place. But as the pressure diminishes, the level of the water within the inner vessel rises, and on the water again coming into contact with the carbide, generation of gas will recommence.

When using carbide of calcium in such an apparatus, the residual lime will fall through the perforated supporter or carrier, and be precipitated at the bottom of the lower vessel; thus displacing its volume of water, with the result that the normal level of water will be increased. But as the carbide is supported by springs or compensating weights, and as its weight will diminish as the lime is deposited, there will be automatic compensation, because the bottom of the carbide will be gradually raised as the water-level is raised by the displacement due to accumulation of lime.

Retort-Charging Apparatus.—Bronder, G. A., of New York City. No. 3577; Feb. 19, 1895.

Apparatus embodying the whole of this invention is intended to receive, from a suitably located elevated bin, a sufficient quantity of coal to charge all the retorts on one side of a stack, to run along the whole length of the range of retorts, and to deliver the coal in automatically weighed quantities to one retort at a time in each of the tiers, or in as many of them as may be desired. The invention comprises a main carriage, provided with wheels, which run on a railway track extending in front of the retorts along the whole length of the stack or stacks to be charged by the apparatus, which carriage consists of a horizontal platform, uprights, and diagonal braces. Upon this carriage the charging apparatus is mounted. Stationary bins are arranged at an elevation near the track, so that the charging apparatus may pass under them, to be loaded with coal. The main carriage has embodied with it, or fixed upon it, a track arranged transversely to the stationary track, and in a direction corresponding with the length of the retorts; the transverse track receiving the supporting wheels of a second carriage E (the scoop-carriage), and which carries scoops corresponding in number with the tiers of retorts, and which are arranged one above another, at such heights as to be capable of entering respectively a retort of each tier in the stack. The main carriage has also supported upon it, by columns, a coal-hopper H, for receiving coal from the bins, and for supplying it to the scoops; the hopper being situated at one side of the scoop-carriage track, and being divided into three compartments of about equal capacity, one for supplying each scoop.

On the main carriage are placed two steam-engines and a boiler G for supplying the engines with steam; one engine being for propelling the main carriage along the stationary track in front of the range of retorts, and the other for propelling the scoop-carriage back and forth on the main carriage, for the purpose of carrying the scoops forward from the side of the coal-hopper into the retorts to charge the latter, and of withdrawing the scoops from the retorts. There may also be on the said carriage a tank, for supplying the boiler with water.

The scoop-carriage E is provided with scoop-supports, consisting of shelves or brackets, arranged one above another, one for each scoop; and under each shelf or bracket are bearings for the journals of two rollers, upon which the scoops are placed. The upper parts of the rollers protrude upwards through openings in the shelf or bracket; one roller being at the rear end of the carriage, and the other at the front end of the carriage, as shown in fig. 1. The front roller of each scoop-support constitutes the fulcrum upon which the scoop oscillates, as a scale beam, for weighing the coal received from the charging-hopper H, as hereafter described; and both rollers serve to reduce the friction upon the carriage of any scoop that may be locked back to the main carriage, in which condition the uppermost scoop is shown in fig. 1, where it is desired to keep that scoop inoperative, while the scoop-carriage runs back and forth with the other scoops, as when it is only desired to charge retorts in less than the whole number of tires, as hereafter explained.

To provide for locking the several scoops, or any number of them, operatively to the scoop-carriage E, as is illustrated in figs. 1 and 2, or

Fig. 1.

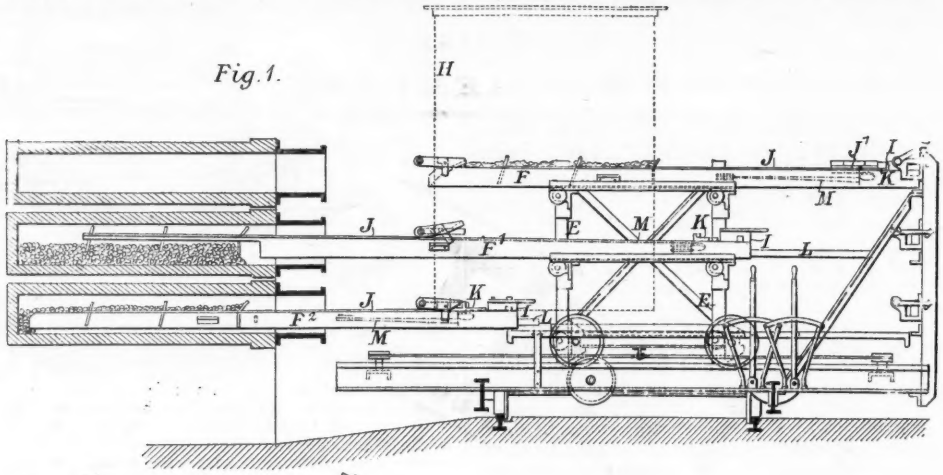


Fig. 2.

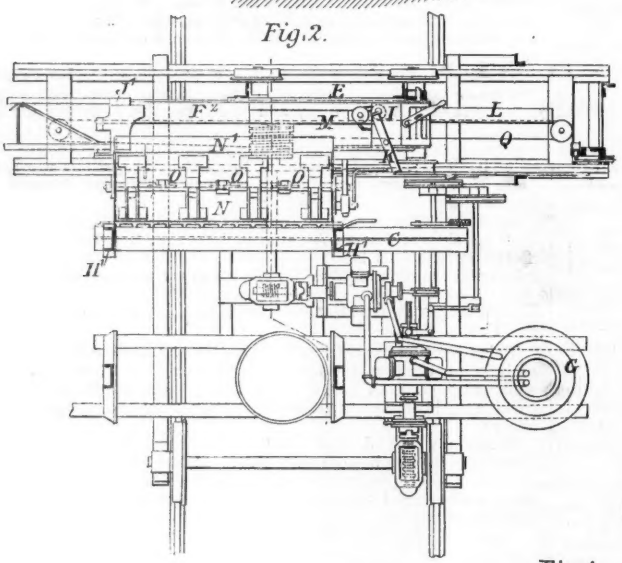


Fig. 3.

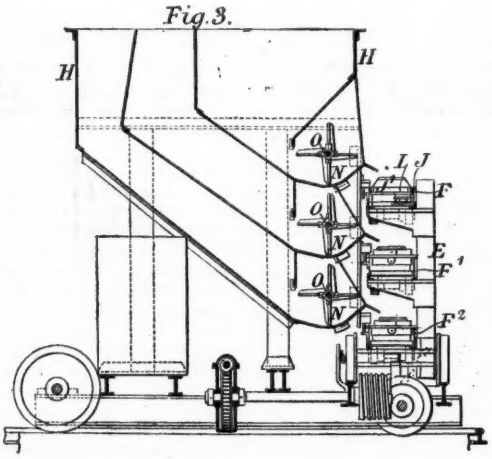
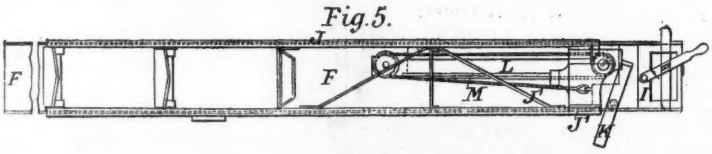


Fig. 4.

Fig. 5.



for locking either one or more of them to the main carriage to render them inoperative, as is illustrated by F in fig. 1, there is provided on the weight I, or rear portion of each scoop, a locking device, consisting of a transversely sliding bolt, manipulated by a hand-lever. By sliding the bolt out from the scoop in one direction, to the position shown in figs. 2 and 5, the bolt is made to enter a staple on the scoop-carriage, and so to lock the scoop operatively to that carriage; and by sliding the bolt in the opposite direction, it is made to enter a staple on the main carriage, to lock the scoop to that carriage where it is inoperative. The staples must be sufficiently elongated in an upward direction to permit the upward and downward movement of the scoop in its operation as a scale beam, as will be hereafter further explained.

The scoops (illustrated in figs. 4 and 5) consist each of a long box or trough, built of steel, and open at the top and the forward end. The rear end of the bottom is recessed (as shown in figs. 1 and 4) to permit the oscillation of the scoop on the forward rollers; and at the same end there is a permanent weight I, by which the scoop is balanced horizontally, with the coal charge in it, and weighted down when empty, so as to tilt up somewhat the forward end. While the scoop is in use, it is locked to its carriage E; and when it is brought back by this carriage to the position for charging, its back end is stopped by, and eventually lies on, an angle-iron bar fastened to the main carriage right under an indicating hand. When the proper coal charge is put in the scoop, it balances the weight I—weighing the coal exactly, and lifting the indicating hand so as to show to the attendant that the proper charge is attained.

Within the scoop, and lying loose upon the upper edges of it, is a scraper-frame, consisting of angle-iron side-bars J and cross-braces J^1, and carrying a series of scrapers, several of which are pivoted to the side-bars in such manner that their lower edges will swing forward, to allow them to pass freely over any coal underneath them, but will stop against the bottom of the scoop when they meet any resistance from the coal in front of them. The rearmost scraper is rigid; and it forms the back of the coal-space in the scoop, while it is drawn back against a stop in the scoop, as shown in fig. 4. The scraper-frame is capable of a movement back and forth relatively to the scoop, to an extent a little greater than the length of that part of the scoop which contains the charge, in order that, first, after the scoop, with the scraper-frame in it, has been moved forward into the retort with the charge of coal in it, nearly to the back end of the retort (as illustrated in fig. 1), the scraper may have a still further movement, to push the charge of coal up to the extreme rear end of the retort; and, second, that the scoop may, while the scrapers remain thus pushed forward, move back far enough (as illustrated in fig. 1) to be withdrawn from the charge in the retort while the scrapers continue to hold back the charge. In order to counterbalance the weight of the portion of the scraper-frame which, with the scrapers, projects beyond the end of the scoop during and immediately after the discharge of the scoop into the retort, the frame is loaded at its rear end by a weight.

For the purpose of producing the continued movement just described of the scrapers within the scoop, beyond the movement of the latter within the retort, a lever K is pivoted to the weight I, or back part of the scoop. One end of the lever bears against the weight, or back part of the scraper-frame; and the other end projects laterally from the scoop, so that during the latter part of the forward movement of the scoop, the projecting end comes in contact with a stop affixed to the bottom of its respective hopper, after which the continued forward movement of the scoop causes the scraper-frame and scrapers to run forward with an accelerated velocity relatively to the scraper.

The detention of the scrapers within the retort, for the purpose of scraping the charge from the scoop as the latter is moved back by the scoop-carriage, is effected by means of a hooked gravity-pawl pivoted to the main carriage. This pawl is shown in fig. 1, and partly in fig. 2. The rearmost cross-brace J^1 of the frame passes under and past the hook of the pawl, as the frame completes its forward movement, and is held by the pawl until the scoop has been drawn back clear of the charge in the retort, when the pawl is tripped out of engagement with the scraper by means of a trip-piece on the outside of the scoop, as shown on the scoop F in fig. 1. This projection does not act directly upon the pawl, but upon an angular tappet-piece pivoted to the pawl, and the upper part of which overlies the edge of the scraper-frame. After the scoop has been drawn back clear of the charge, the trip-piece on its side strikes the lower pendant portion of the tappet, and so presses down its upper part on the edge of the scraper-frame that the tappet operates as a lever to raise the pawl and unlock the frame.

The drawing back of the scraper-frame, to bring the scrapers into the scoop, is effected by means of a bar L (the backing-bar), two pulleys, and a wire rope or chain M, shown in figs. 4 and 5, and also partly in figs. 1 and 2. The backing-bar is fitted to slide back and forth lengthwise of the scoop in guides provided within the frame. While the scraper-frame is held stationary, as described, to permit the discharge of the scoop into the retort by the drawing back of the scoop, the bar L is projected back through the rear of the scoop, as shown in the scoop F^1, with a movement of two to one in proportion to the movement of the scoop, by means of the pull of the scoop on the rope or chain M passing around the pulleys shown. This projection of the backing-bar continues until the scraper-frame has been unlocked by the lifting of the pawl. The bar is then immediately, by the continued movement of the scoop, brought against the stop on the main carriage; and by the further continued backward movement of the scoop, while the bar is so stopped, it is caused to be returned with the scoop, and, by the action of the rope or chain M and pulleys, to draw back the scrapers to the position they are to occupy while the latter is being charged, and while it is running forward to charge the retort—which position is shown in figs. 4 and 5, and in the scoop F in fig. 1.

In fig. 1, wherein the operation of the arrangement is fully illustrated, only one of the scoops F^1 is shown in operative connection with the scoop-carriage E; the lower scoop and its appurtenances being shown in the position which is connected operatively with the carriage they would occupy when it is in its most forward position; and the uppermost scoop F is shown in the position it would occupy when the carriage is in its rearmost position. There are thus shown three positions of the scoops in one figure, to avoid the necessity of three different representations of the side elevation of the machine with the scoop-carriage in as many different positions. The scoop-carriage in this figure is shown in the act of running back with the scoop F^1 the scrapers of which are still in the retort wherein they have deposited the coal from the scoop.

To describe the charging operation, it is first supposed that all the compartments of the hopper H have been charged under and from an elevated bin, and the scoop-carriage is in its rearmost position close to the rear uprights of the main carriage. The empty scoops, or as many of them as are to be used, are locked to the carriage E, and are then opposite the hoppers, with their front parts tripped up to receive coal from the troughs N of the hoppers. The main carriage being now brought to a position in which the scoops are opposite the retorts, the scoops are charged, not directly from their respective hoppers, but from the troughs N, which are kept supplied from the hoppers, the charging being entirely under the control of the attendant, who, by hand-cranks O^1, turns the scraper shafts O and scrapers, which latter raise the coal from the retaining troughs, and cause its delivery therefrom over the shutes N^1 into the scoops. The attendant, as he thus loads a scoop, watches the index-hand until, when the scoop has received the weight of coal necessary for the charge, the weight I is counterbalanced, and is caused to raise the index-hand. The coal thus loaded and weighed in the scoop lies between, and in front of, the scrapers, which are in their rearmost position in the scoops. The engine is now started to run the scoop-carriage forward, and carry the coal-laden scoops into the retorts; the front ends of the scoops being brought not quite to the rear of the retort, as illustrated by the scoop F^2 in fig. 1. In this position, the movement of the scoop-carriage, scoops, and scrapers is arrested by the automatic stoppage of the engine, produced by the rear axle of the carriage striking the front tappet of the tappet-rod; but just before this stoppage occurred, the forward movement of the scraper-frames and scrapers had been accelerated by the action of the lever K (fig. 5), as already explained, and the coal in the scoops (which, up to that time, had its front portion sloping backward from the end of the scoop, as indicated in fig. 4) was, by the accelerated movement, pushed forward in the scoops, and a portion of it was pushed out therefrom, as illustrated in the scoop F^2 in fig. 1, into the rear parts of the retorts, and against the rear ends of the latter, where "they are the hottest, and the generation of the gas is most effective." The scraper-frames are, by the accelerated movement just mentioned, brought to such a position that their rear cross-braces J^1 pass the hooks of the pawls.

To run back the scoop-carriage and scoops, the attendant reverses the engine. But during the first part of this movement, the scraper-frames are detained by the pawls, and the scrapers are held back; and the coal, being held back by them, is discharged from the scoops into the retorts, as illustrated by the scoop F^2 in fig. 1. This discharge of the coal from the scoop lightens its front ends, so that the ends and the scrapers are lifted (as illustrated by the scoop F^1 in fig. 1) by the weights on the rear ends of the scoop and the scraper-frame; the scrapers being, by this lifting, raised nearly clear of the coal in the retort. When the scoops have run back clear of the coal in the retort, their projections lift the pawls and liberate the scraper-frame, so that the frames and the scrapers will be free to be drawn back into the scoops by the action of the backing-bar and cord or chain M, in combination with the pulleys, as already explained. The scoops are now in position relatively to the hoppers, to be refilled for a repetition of the charging operation, when the main carriage shall have been moved to the next retort.

Gas Heating and Cooking Stove.—Lönholdt, F., of Frankfort-on-the-Main. No. 18,945; Oct. 9, 1895.

This invention relates primarily to a closed heating gas-stove, comprising a series of vertical flues for the escape of the products of combustion, arranged side by side with intervening spaces adapted to serve for the passage and warming of the air supply, and a gas-burning apparatus contained in an enclosed chamber arranged in front of the lower parts of the vertical flues, so as to discharge the products of combustion into the lower portion of the flues. The object aimed at is "to ensure the utilization of the heat in a more advantageous manner than heretofore, by so directing the course of the escaping products of combustion [the latter being effected in a manner similar to that described in patent No. 22,565 of 1894] as to cause them to give up a larger proportion than usual of their heat to the air, by means of which the process of combustion is maintained."

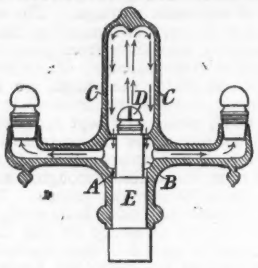
In both the cooking and heating forms of the stove, means are provided whereby, at starting, part of the products of combustion are allowed to pass directly into the chimney, for the purpose of heating it; and thus inducing a sufficient draught. The cooking-stove is further so arranged that the flames do not impinge directly upon either the oven or other spaces, or the vessels to be heated, which receive heat partly through the radiation of the heat rays from a reflector, and partly from contact with the products of combustion flowing in a stream extending across the entire width of the hot-plate, and thence passing around the spaces to be heated.

Burners for Gas Cookers, Stoves, &c.—Thompson, W. P.; a communication from C. Wolff and A. Behl, of Quedlinburg, Germany. No. 20,583; Oct. 31, 1895.

This invention has for its object the construction of a burner in which the speed of discharge of the gas does not alter with the rate of consumption; but the section of discharge is altered—the gas-nozzle being with this object divided into several parts, to be closed according to requirements. For this purpose, the nozzle is not bored singly, but is provided with several passages; and by means of a rotatable disc or the like, the separate passages can be closed or opened to correspond to the actual consumption. The speed of discharge of the mixture of gas remains always unchanged; as the burner opening is simultaneously and automatically closed or opened with the regulation of the gas-nozzle. With the object of obtaining a thorough admixture of the gas and air, a chamber is arranged so that the current of mixed gas and air can move unimpededly forward. There is also an arrangement by means of which, when the flame is turned down, a mixture of gas poor in air, with a low rate of explosion, may be supplied, which burns with a large flame, and will not strike back so easily towards the nozzle, and cannot be extinguished by a draught of air.

Gas-Burners.—Knapp, C., of St. Louis, Missouri, U.S.A. No. 20,588; Oct. 31, 1895.

One of the objects of this invention is to construct a gas-burner to be placed over the tip usually secured to the gas-fixture, without the employment of screw-threads; but the main feature of it "is a superheating dome, which is heated by the illuminating flame of the gas, and wherein the gas is expanded before it is consumed at the burner-tip."



Formed in the base of the burner, and extending a suitable distance above the lower edge of it, is a tapering bore A; and immediately above this (and in communication with it) is an annular enlarged chamber B, into which the gas passes before it issues to the burner. There are two arms in the present instance, projecting in opposite directions, and each provided with upwardly turned ends. In these ends tips are inserted, the flames from which impinge against the dome C. This dome is provided with a closed top, and extends some distance above the arms, and midway between the tips. An inwardly concave nipple is formed in the inner upper end of the dome, for deflecting the gas issuing from the gas-supply tip D; the gas being thus compelled to follow the heated walls of the dome. The inner chamber of the dome is contracted at the base, forming a narrow contracted passage about the upper end of the shell when inserted into the burner, as shown. By this contraction, the gas is forced to follow the path indicated by the arrows—that is, it first fills the chamber above D, and then escapes by way of the contracted passage into the annular enlarged chamber B, whence it passes into the passages of the arms, and finally to the burner-tips.

APPLICATIONS FOR LETTERS PATENT.

24,567.—Mason, H. G., "Pneumatic gas regulator and controller." Dec. 23.

24,570.—Richmond, E. W. T., "Gas cooking apparatus or burners." Dec. 23.

24,600.—Dargue, J. A., and Griffiths, E., "Circulation or conduction of water, air, steam, or any other fluid or gas." Dec. 23.

24,625.—Preston, E. J., and Cornish, A. T., "Valves for pipes for water, gas, and other fluids under pressure." Dec. 23.

24,659.—Hutchison, D. L., "Measuring or recording the quantity of water or other fluid passing over a notch or sill, or through a channel." Dec. 24.

24,664.—Moyes, L., "Regenerative and other furnaces." Dec. 24.

24,666.—Holliday, T., and Exley, J. H., "Manufacturing acetylene gas." Dec. 24.

24,792.—Rogers, J. E., "Gas and explosive vapour engines." Dec. 27.

24,823.—Stinnes, H., "Coke-furnaces." Dec. 27.

24,826.—Holliday, T., "Gas-burners." Dec. 27.

24,839.—Moeller, J., "Atmospheric gas-burners." Dec. 27.

24,840.—Moeller, J., "Making oil gas." Dec. 27.

24,885.—Gale, J. R. C., "Electrically controlling the supply of gas and other fluids." Dec. 27.

24,891.—Gathmann, E., "Gas or oil engines." Dec. 27.

24,920.—M'Dougall, A., "Treatment of organic matters containing nitrogen for the production of ammonia and residual products." Dec. 30.

24,972.—Shaw, E. J., "Pendants for gas and other lighting purposes." Dec. 31.

24,996.—Glover, R. T. & J. G., "Gear for coin-freed apparatus for the sale of gas." Dec. 31.

Companies Wound Up in 1895.—Among the companies wound up voluntarily last year with a view to reconstruction were Pintsch's Patent Lighting Company and the Odessa Water-Works Company. The British Steam Generator and Refuse Utilization Company (Livet patents) was wound up by order of the Court.

New Joint-Stock Companies.—The Dolgelly Gas and Coal Company, Limited, has been registered with a capital of £10,000, in £10 shares, to acquire and carry on the business of the Dolgelly Gas Company, and to enter into an agreement with the Company and their Liquidator (Mr. A. Whittingham). The Metropolitan Water Supply Syndicate, Limited, with a capital of £2000, in £1 shares, is to "develop, perfect, and work a scheme invented by J. Casey for increasing the existing supply of water to London."

Regenerative Retort-Settings for the Evesham Gas-Works.—At the meeting of the Evesham Town Council last Wednesday, Mr. Lowe, the Chairman of the Gas Committee, spoke at some length in favour of the adoption of the regenerative principle of heating the retorts at the gas-works. The monetary gain which would result from the change he put as follows: The additional amount of gas which would be obtained from the coal carbonized would give an extra income of £300 a year; three stokers could be dispensed with, representing £170 a year; and fully 200 tons of coal would be saved, which was equal to £100. These three items would mean a saving of £570 per annum; and an expenditure of £1000 or £1500 to obtain this further income would not be a bad investment. After discussion, the minutes of the Committee were passed, including authority to obtain plans for the conversion of the retort-settings. Before proceeding with the work, the Committee will again report to the Council.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Advertising Vacant Managerships.

Sir,—I should like to draw your and others' attention to what I consider a great nuisance. I allude to the practice of gas companies (and others for that matter) who, when a managership becomes vacant, advertise for applications for the post, while at the same time the company have a man ready to put into the place even before the advertisement appears in print. I should like to ask: Of what use is it to give would-be applicants the trouble of writing out their testimonials, together with the application, &c., when the company know perfectly well that such application will be fruitless?

I will give a case in point. A vacancy for a gas manager occurred at a small town a short while ago; and I, for one, applied for the post. The applications were to be in by a certain date; and the day following that date I was surprised to receive a note to the effect that my application was unsuccessful. Now, Sir, I should like to know why, if a gas company have a man to put into the late manager's place, they need advertise at all. Surely it is of no use putting the applicants to such an amount of trouble, and, what is worse, anxiety as to whether or not they will be successful.

"Canvassing the directors will disqualify," is a remark nearly always seen in the advertisement. But, Sir, there are very few cases where an outsider has any chance whatever, unless he does directly or indirectly canvass the directors. The time has gone when a gas manager's place can be had by merit alone.

Jan. 4, 1896. An Applicant.

Suffocation by Coal Gas.

Sir,—The lamentable death of the Rev. W. Evans Hurndall, indirectly due to his inhaling for an indefinite period certain fumes arising from a gas-stove, points a moral which I think we may do well to consider. From all accounts, it would appear that the accident was owing to incomplete combustion of gas in the room in which the deceased gentleman and his wife were sleeping. The verdict of the Coroner's jury suggests that the danger was intensified by the want of a proper flue connection with the chimney. Be this as it may, I am of opinion that the mere fact of the burner firing-back or lighting-back at the gas nozzle inside the air-inlet chamber, with probably the production of a large quantity of acetylene gas, is quite sufficient in itself to account for the accident. Owing to the conditions attending this trouble, to which so many gas-fires are liable, there is practically no heat produced; the chimney cools, and free gas (together with the products of incomplete combustion) are more likely to pass into the room than up the chimney.

The liability to accidents arising from this cause is bound to increase with the extended use of bedroom gas-fires, unless some change is made in our existing regulations relating to main pressure changing, or until we take some proper means for advising consumers with reference to the use of such appliances. Under ordinary circumstances, the consumer will, before retiring to rest, turn the fire down as low as he considers safe. Unless he has been exceptionally well-advised, and has acted accordingly, he will, in the small hours of the morning, when the pressures are universally much reduced, be liable, owing to the fire being thereby still further lowered, to the danger just referred to. Hence the obligation we are under to well inform our customers upon all these and other points necessary to secure the efficient, yet safe, use of the gas-utilizing apparatus which we spare no pains to get out at work in the district. The alarm which has been aroused by this fatality, although much to be regretted, is not unnatural; and nothing is better calculated to dispel such fears than the dissemination of reliable information.

Then, again, with reference to the treatment of asphyxiated persons, there seems even now to be a remarkable misconception. The patient should be laid flat down, with the head slightly raised; the clothes loosened about the neck and chest, but the body kept warm; and restoratives applied with the greatest caution. Sitting up on a chair is about the worst possible position. If necessary, attempts must be made to secure artificial respiration, precisely similar to those prescribed for drowned persons.

The best antidote to asphyxia is pure oxygen. This can be most readily and successfully applied direct from the well-known high-pressure cylinders which, for this reason, are now kept in stock by some of the hospitals and dispensaries. The beneficial effect of such application is simply extraordinary. Oxygen made by the chlorate of potash method must, of course, be avoided, as it contains injurious impurities. No gas management should be without a stock of these cylinders, not only for use with their district workmen, but also to be sent for in case of accidents to consumers such as that referred to above.

35A, *Great George Street, S.W., Jan.* 4, 1896. T. Ebenezer Pye.

Professor Lewes on "Flame."—At the Royal Institution, Hull, last Tuesday, Professor Vivian B. Lewes delivered an interesting lecture on "Flame." He traced the periods of the discovery of vegetable and mineral oils, and brought his story down to the beginning of the present century, when coal gas was introduced, and ten years later was put into competition with the electric light. The latter light, however, was not going to have its own way, for the bright incandescent gas-light, fitted with proper globes, was, he believed, the light of the immediate future. He then, by experiments and diagrams, lucidly explained the various compositions of the gaseous mixtures from which light is furnished, and, coming to flame, said it was simply gas entering into combination with the oxygen of the air with such rapidity as to develop the energy of the chemical action in the form of heat and light. A hearty vote of thanks was accorded to Professor Lewes. The British Gas Company fitted up the Lecture Hall and Museum with incandescent burners of the latest types; illustrating the brilliant effect of these burners as compared with the ordinary kinds.

LEGAL INTELLIGENCE.

The Frauds upon the Bristol Gas Company: An Exemplary Punishment.

At the Bristol Police Court last Tuesday, the Magistrates (Messrs. Low and Baker) resumed the hearing of the charges against Henry Harris, an ironmonger and gas-fitter, of having, on two occasions—in 1887 and 1895—feloniously stolen from the Bristol Gas Company a quantity of gas by means of a contrivance for disconnecting the meter on his premises. [The proceedings at the first hearing were reported in last week's issue.] At the outset, the Bench agreed, after hearing Mr. Salter for the defendant and Mr. Weatherly for the Company, to use their jurisdiction, and deal with the case themselves. Mr. Salter then said that his client desired to withdraw his plea of "Not guilty," and to plead guilty to the offence. He earnestly appealed to the Bench to deal with the matter by imposing such a fine as they thought the justice of the case might require. Mr. Harris was a man who had occupied a respectable position, and who had conducted himself honourably and respectably for a period of eighteen years in the city of Bristol; and during the whole of that time, with the exception of this unfortunate occurrence, he believed that nothing whatever could be alleged against him. He (Mr. Salter) suggested that it was when a man was in great trouble that his previous good character ought to stand him in good stead. If it had not been for technical reasons, Mr. Harris might, and he had no doubt would, have been charged under one or other of the sections that related to fraudulent dealings with gas. There were at least three sections of Acts of Parliament that created offences in regard to tampering with meters; and in each of those cases, pecuniary penalties were imposed. This offence, though certainly a common-law larceny, might have been charged as a statutory offence under one of the Acts relating to gas. Then there would have been no question of imprisonment; and the only result would have been the imposition of a penalty. He urged upon their Worships that a technical difference—Mr. Harris being charged with a common-law offence instead of a statutory fraud—ought not to make any difference between imprisonment and a fine; but that the Bench should deal with the matter by imposing a fine, as they would undoubtedly have done in one of the other cases. Mr. Weatherly, in addressing the Court, remarked that there could be no concealing the fact that defendant suffered a great portion of the punishment which was due to him by having to stand in the presence of the public, and to confess to offences which were separated by a long and significant interval—from 1887 to 1895. But the prosecution, having brought before their Worships all the facts of the case, felt no desire to aggravate the position in which Mr. Harris found himself. The Board of the Company desired that their Worships should deal leniently with the case, having, of course, regard to the seriousness of the offence. He was happy to be able to support the application of his friend, that the case might be met by the imposition of a fine. The Magistrates having conferred for a short time, Mr. Low said they could not avoid looking at this as a highly serious matter. Defendant had pleaded guilty to having, practically for a long series of years, persistently robbed the Gas Company, whose confidence he had, and whose money he received constantly for work done. It was impossible—it would be unjust to the community at large—that the Bench should not deal very seriously with the matter. Their decision was that defendant be imprisoned for three months with hard labour—the term to cover both charges.

Gas-Meter Testing at Birmingham.—The Birmingham Magistrates last Wednesday received a report from the Inspector of Gas-Meters upon his work during 1895. He stated that there had been a large increase in the number of meters received for testing; and, as the meter-makers in the city were extending their works, he had no doubt that the increase would continue during the ensuing twelve months. In 1895, 13,311 meters were tested, against 9439 in 1894; and the receipts were £457 1s., against £377 16s. 6d. Eighty meters had been rejected during the year as incorrect. The Magistrates hope to shortly secure more suitable offices for the Inspector; the present premises being inadequate for the work.

Middlesex Gas Consumers and the Companies.—The following appeared in the "Daily Chronicle" last Thursday: "For some time past, consumers of gas in Middlesex have felt great inconvenience from the necessity of sending their meters to the City for the purpose of being tested in cases where there have been assumed overcharges on the part of the Companies. It will be seen what this means when it is remembered that some parts of the county supplied with gas are 20 miles from a gas-testing office; and there is no provision for the testing of the quality of the gas supplied without the Metropolitan area by the Metropolitan Companies. This grievance has resulted in the Middlesex County Council proposing to the County Councils' Association that powers should be obtained to place all County Councils on the same footing in this respect as that of London, which has the power to appoint inspectors and examiners."

Progress of the New Water-Works for Bilston.—The members of the Bilston District Council last week inspected the new water-works which are being constructed for them at the Bratch, Wombourn. Since the laying of the foundation-stone of the engine-house a few months ago, the building has been completed, and the engines placed in position. The greater part of the work has been accomplished in laying down the pipes to convey the water from the Bratch to the reservoir at Goldthorn Hill at Wolverhampton, whence it will gravitate to Bilston. The contractor for the sinking of the wells has made one 150 feet deep; but considerable difficulty has been experienced in excavating the other, owing to the large volume of water which has to be dealt with. Now, however, that the pumping machinery has been put down, it is hoped that much more rapid progress will be made with the second well, and that the inhabitants will be able to be provided with water from this source about June next. The scheme was designed by Mr. Baldwin Latham.

MISCELLANEOUS NEWS.

GAS-STOVES IN BEDROOMS.

Death of the Rev. W. E. Hurndall—Inquest.

In the "JOURNAL" for Dec. 24, under the above heading, we reported an accident that had occurred to the Rev. W. E. Hurndall, M.A., and his wife, at 90, St. Ermin's Mansions, Westminster. On the information then to hand, it was stated that during the night of Saturday, Dec. 14, there had been an escape of gas from a gas-fire in the bedroom; and, on the following day, the reverend gentleman and his wife were found lying in a comatose condition in the room. It now appears that the fire was alight all night, and that the cause of suffocation was the emission of fumes from the stove through circumstances explained below. Although every effort was made to resuscitate him, Mr. Hurndall continued in a practically insensible condition until he died last Tuesday. His wife is still in a precarious state.

The inquiry into the cause of the death of the reverend gentleman was held by Mr. JOHN TROUTBECK, at the Coroner's Court, Westminster, on Friday last.

Mr. H. CHETHAM represented the relatives of the deceased; and Mr W. C. BEASLEY ROBINSON, The Gaslight and Coke Company.

Mr. *Piper*, one of the deacons of Westminster Chapel, of which the Rev. Mr. Hurndall was pastor, stated that the deceased was 49 years of age. He was not officiating at the chapel on Sunday, Dec. 15; but, hearing in the afternoon that neither he nor his wife had been seen during the morning, witness called at St. Ermin's Mansions. He was informed by the servants that, on retiring to bed on Saturday, Mr. and Mrs. Hurndall had expressed a wish not to be disturbed on the following day until they rang. Witness went to their bedroom, and, not receiving a reply after knocking, he opened the door, and was met by what he described as a "hot blast of dry air." The gas-stove was fully alight; and he had it put out. He described the steps he took to revive Mr. and Mrs. Hurndall, who were both unconscious in bed; and stated that he immediately sent for Dr. Scott. The windows were tightly shut; and there were draught excluders round the door.

The two servants then gave evidence to the effect that Mr. Hurndall had not been well for some few days previously; and therefore, after receiving instructions not to disturb him and Mrs. Hurndall, they did not think it strange they remained in their room till so late in the day.

T. C. Pash, a gas-fitter in the employ of The Gaslight and Coke Company, deposed that he fitted the gas-fire in the bedroom on Nov. 14. It was one of Richmond's "Majestic" fires. There was an outlet for the fumes at the back, to which was connected an elbow-piece, and to that a pipe, ending with a cone. This pipe led up the chimney, through a plate which had been placed on the top of the register of the coal grate. [The stove and fittings were then brought into Court, and the connections explained to the jury by witness.] There had been a gas-fire there previously; and he was simply sent to exchange the stoves, and was not instructed to remove the fittings. He did not notice any down-draught from the chimney.

By Mr. CHETHAM: Witness thought the projecting piece at the back of the stove was long enough to hold the elbow in position, providing the stove was not forcibly pulled out of place. The gas supply-pipe at the bottom would prevent the stove being moved to any extent.

Witness was here requested by the Coroner to fix the pipe and then work it backwards and forwards; and afterwards the Coroner expressed the opinion that the slightest push at the top of the stove would work the chimney off the projecting piece.

By the JURY: The upper portion of the chimney fitted inside the elbow piece; but witness would have fitted it outside if it had been large enough. [It should be mentioned that the upper part of the flue was a portion of the old fitting.]

Dr. *H. Scott*, who was called in to attend Mr. and Mrs. Hurndall, stated that he tested the stove a few hours after the accident; and he smelt the fumes coming through the top. He had made a *post-mortem* examination of deceased; and he attributed his death to primary suffocation and congestion of important parts of the body. He had no doubt death was due to breathing gas-fumes.

Alfred Pitt, a foreman fitter of The Gaslight and Coke Company, said he examined the stove a few days after it was fixed; and, in his opinion, it then acted well. Mr. Hurndall came into the room while he was there, and said he was perfectly satisfied with it. There appeared to be a good draught up the chimney.

Mr. *G. H. Holman*, an architect and surveyor, and a friend of the family, said that, a fire being required in the room, he had the gas-stove removed on Thursday, Dec. 19. He found that the chimney had becomed detached, and the elbow was resting on the bottom bars of the grate. The plate which had been referred to was on the iron part of the register. The effect of this was to completely block up the flue; and, consequently, there were no means of escape for the products of combustion. If the chimney had fallen away while they were disconnecting the stove, they would have heard it.

Mr. ROBINSON asked why, as the Gas Company were interested in the matter, notice was not given them that the stove was to be removed. In reply, witness said that the fire was wanted; and, in fact, he was not told until the Thursday, when it was removed, that the stove belonged to the Gas Company. When the stove was taken out, the flue was standing in the fire-place.

By the CORONER: Witness was previously under the impression that the gas-fire had been fixed by the workmen connected with the mansions.

The CORONER: It is a great pity the stove was disconnected without notice having been given to the Gas Company.

Walter Williamson, a fitter also in the employ of the Gas Company, said he attached the chimney to the first gas-fire on Oct. 10. The iron plate was put in then at Mr. Hurndall's own request to stop the down draught. His great idea seemed to be to exclude all draught from the room.

By Mr. ROBINSON: When the first stove was fixed, the back of the

flue fitted tightly against the back of the register. The plate would have the effect of holding the flue in position.

Mr. *Holman* (recalled) said the old grate was circular in front, so that the gas-stove could not fit tightly against the register.

William Carder, a gas-fitter, who removed the stove on Dec. 19, said he disconnected it very slowly (knowing what had happened), in order to ascertain the fault; and he found the flue in the position described by Mr. Holman. The projecting piece at the back of the stove to which the elbow had been fitted was only about 1 inch in depth. This, in his opinion, was not sufficient; it should have been at least 3 inches. He was certain the moving of the stove did not bring the flue down. Had he fixed the stove, he should have put legs under the elbow to support it. The stove, after being fixed, could have been pulled forward; but, unless it was wilfully done, it would not shift. The upper portion of the flue should have been connected to the elbow outside, and not inside, as was the case here. There were dents in the portion of the pipe at the joint with the elbow into which he could put a finger.

In answer to Mr. CHETHAM, witness said that, if the stove was badly lighted, the bang which would result would have a tendency to work off the elbow from the projecting piece. In his opinion, the fire was improperly fitted.

Questioned by Mr. ROBINSON, witness said he had fitted gas-fires with 3-inch projecting pieces at the back; but those stoves were not by the same makers as the "Majestic."

The CORONER, in summing up, said he was afraid it could only be a matter of conjecture as to how the flue became disconnected. From the evidence, however, it was clear that death was caused by the flue becoming detached, and the chimney being blocked by the iron plate, so that the products of combustion could only escape into the room. The stove was of a well-known and common shape. The projecting piece at the back had been criticized. It was said that it ought to have been 3 inches long, instead of only about 1 inch; and possibly that was a good criticism. The stove was widely used; and it would be a strange thing to say there was any culpable negligence on the part of anybody in fixing such a stove. The small explosions caused by the fire being badly lit would tend to drive the elbow piece backwards, or it might become detached by a series of little vibrations. There were many ways in which the flue might have been gradually shifted. He therefore thought it was for the jury to say that death was due to accident.

The jury, after retiring, returned the following verdict: "Accidental death by fumes of gas, caused by displacement of chimney; but how displaced, there is not sufficient evidence to show."

THE PROPOSED ACQUISITION OF THE CHELTENHAM AND LEAMINGTON GAS-WORKS BY THE CORPORATIONS.

The Bills promoted by the Corporations of Cheltenham and Leamington to obtain power to acquire the undertakings of the Gas Companies in those towns, were duly deposited in the Private Bill Office towards the close of last month. The following is an epitome of their provisions:—

The preamble of the Cheltenham Bill sets forth that, by an Act obtained in 1856 (which repealed a previous Local Act of 1819), the Cheltenham Gas Company was continued, incorporated, and authorized to supply gas for public and private purposes within the parishes of Cheltenham, Leckhampton, Prestbury, Charlton Kings, and Swindon, all in Gloucestershire; the limits being extended, by an Act of 1872, so as to include Up Hatherley, Badgworth, Shurdington, and Staverton. Under the latter Act, the Company were authorized to supply gas in Cheltenham at any price up to 4s. per 1000 cubic feet; 1s. more being allowed elsewhere. The Company, having obtained all the money they were authorized to raise, with the exception of £20,000 they could borrow under their Act of 1872, have promoted a Bill to get further capital, purchase more land, and construct additional works. This being so, the Corporation consider it is expedient that they should be empowered to acquire and carry on the undertaking, and raise money for the purpose. Coming to the clauses, it is specified in the third that the purchase is to be by a cash payment or by way of annuities, or partly in one way and partly in the other, on terms to be settled by agreement or arbitration under the Arbitration Act, 1889. The next clause specifies that the transfer is to be effected by deed; and until it takes place, the undertaking is, of course, to be maintained and carried on by the Company. Servants of the latter are to retain their respective positions under the Corporation. The purchase-money is to be applied in payment of the Company's debts and liabilities, and in satisfying the claims of the shareholders or their representatives; and until the Company's mortgages are paid off, this debt and the interest are to be a first charge upon the undertaking in the hands of the Corporation, and upon the borough fund. If the consideration for the transfer is by annuities, the amounts are to be fixed by agreement or arbitration; and they are to be payable half yearly. The succeeding clauses of the Bill relate to the annuities; and then comes the provision for the winding up and dissolution of the Company. The next portion of the Bill deals with the manufacture and supply of gas. Powers are to be sought to carry on the undertaking and manufacture gas and treat residuals on the present sites or others, to the extent of ten acres, to be acquired by agreement. The limits of supply are to be those of the Company; and the price to be charged is not to exceed 3s. per 1000 cubic feet, either within or beyond the borough. The pressure is to be 8-10ths from midnight to sunset, and afterwards 10-10ths. The gas is to be of 16-candle power when tested at the Corporation's station; and not more than 5 grains of ammonia or 20 grains of sulphur are to be allowed in every 100 cubic feet of gas. The Corporation will ask for power to sell gas in bulk, or even a portion of the undertaking, to neighbouring sanitary authorities. The remaining clauses of the Bill relate to the borrowing of money, the formation of a sinking fund, and the application of the gas revenue. After paying all costs and charges incidental to the undertaking, the balance of revenue, so long as the price of gas does not exceed 2s. 4d. per 1000 cubic feet, is to be carried to the borough fund, and either be applicable as surplus of that fund or in reduction of the rates.

In the Bill promoted by the Leamington Corporation, which is for obtaining powers to ensure the better government and general improvement of the borough, they will ask to be authorized, at any time within five years from the commencement of the Act, to require the Leamington Priors Gas Company to sell their undertaking on terms to be settled by agreement or by arbitration. The Company is to be dissolved, and their debts and liabilities transferred to the Corporation, who are to have authority to maintain, improve, enlarge, or discontinue the existing works, and erect additional works and plant for supplying gas within the Company's limits, as specified in their Act of 1865.

THE DARLINGTON IMPROVEMENT BILL REJECTED.

Notice of a Poll of the Ratepayers.

The Darlington Town Council held a lengthy sitting last Saturday week, for the purpose of consideriug their position respecting the proposed Extension and Improvement Bill (which contained important clauses referring to gas, water, and electricity supply), having regard to the manifestation of opinion at the public meeting on the preceding Monday, as reported in the last issue of the "JOURNAL." The discussion turned upon provisions dealing with matters in which our readers are little concerned. It was agreed to make certain eliminations in connection with the extension clauses, and concessions relating to the provisions for the better regulation of the streets. At the public meeting, there was some question as to whether it would not be possible to obtain the powers required in the form of a Provisional Order instead of an Act. The Council were, however, told that the Town Clerk had again taken advice on the subject, and was definitely informed that it was impossible to procure the necessary powers, especially those with respect to the extension of the gas-works and the use of new land for gas purposes, except by an Act. Most of the extended powers with reference to water supply and sanitary matters were also only obtainable by an Act. The whole of the powers with respect to the issue of corporate stock, too, could only be obtained in this way. Therefore by proceeding in the manner suggested, the Corporation would at once appear before the final tribunal for dealing with such matters, and incur but one set of expenses; whereas, if some powers which could be had by Provisional Order or otherwise were so obtained, still others would require an Act of Parliament, and the result would be to largely augment the cost of getting what was required.

The adjourned meeting of ratepayers was held on Monday last week; the Mayor (Mr. J. J. Wilkes) again presiding. There was a larger attendance than on the previous occasion; and throughout the meeting was of a most turbulent character. His Worship (amid repeated interruption) explained the decision arrived at by the Council at their meeting on the preceding Saturday. The Town Clerk also made a statement, and pointed out that it was absolutely necessary to have further borrowing powers, in order that they might extend their works to meet the demands of the increasing population. A Mr. Hildreth protested against the legality of the meeting; but the Mayor ruled otherwise. Mr. Hildreth proceeded to say that, under the Municipal Corporations Borough Funds Act, section 4, it was necessary, before any expenditure in relation to——but the sentence was broken off by the Mayor interrupting with, "You are out of order, and have no right to continue." Mr. Hildreth thereupon warned the Mayor and Corporation against "the consequences" of carrying on the meeting. The "betting clause," which was evidently regarded with great disfavour, then claimed the attention of the ratepayers; but the provisions relating to more important matters seem to have been altogether ignored. Eventually, it was, practically unanimously, decided to postpone the consideration of the Bill for twelve months. This was followed by an even more drastic amendment by Mr. J. A. Pease, M.P., that the Bill be withdrawn. This was also carried almost unanimously. Mr. T. James then gave notice that he should demand a poll.

The necessity for some extensions at the gas-works was emphasized at the meeting of the Town Council on Thursday, when, in reply to questions, Alderman Barrow stated that all the retorts were in working condition; but the time was fast approaching when they would not be able to keep pace with the demand for gas in the town. With regard to the question of storage, they had not sufficient to meet a day's supply at the maximum demand. Sunday labour was regularly called in at the gas-works in the winter time; and it was absolutely impossible to dispense with it, though both the Committee and the workmen would gladly do so. It was impossible to do without Sunday labour so long as the storage capacity was so insufficient as at present.

Water-Works Improvements at Malton.—The Malton District Council have resolved to spend £2058 in improving their system of water supply; and the Local Government Board are to be asked to sanction the borrowing of the money. The scheme embodies a new pumping-engine and boiler (£920), the construction of a new tower reservoir (£962) to hold 53,000 gallons of water, and capable of giving a constant supply to the highest houses in the town, the laying of a new 5-inch main, and other works.

The New Auxiliary Water-Works for Leicester.—Satisfactory progress is reported in connection with the works which the Leicester Corporation are constructing for improving the water supply. The new engine and boiler-house at the Cropstone pumping-station have been completed, and are now at work; and four new filter-beds are almost ready for use. During the year, a contract has been entered into for a high-level service reservoir at Hallgates Spinney; and this work is also nearly finished. The work at the storage reservoir at Swithland is being vigorously prosecuted, and is likely to be completed in the early part of the year.

THE PREPAYMENT GAS-METER SYSTEM IN BIRMINGHAM.

[Extracts from an Article in the "Birmingham Post."]

The introduction by the Gas Committee of the Birmingham City Council of the system of prepayment meters into the houses of the working classes has been so successful that its development is only a matter of time; indeed, it may ultimately compel the consideration of the question whether the scheme could not with advantage be extended to all kinds of house property, and, perhaps, to many business premises. The necessity of doing something to popularize the use of gas in small houses has for a long time occupied the attention of various gas companies, and especially the department in Birmingham. It was found that the number of small meters was rapidly diminishing, mainly through the practical abolition of the three-light meter, in consequence of the gas being extended to other purposes than that of lighting. When the Birmingham Corporation acquired the gas undertaking from the old Companies, they became aware that the number of small houses in which gas was used within the area of supply was very much smaller than in many other manufacturing districts; and they devised various means for attracting that class of consumer by relaxing the system adopted by their predecessors of asking for deposits as security and abolishing the fourth scale of charges—a scale by which consumers of gas under 10,000 cubic feet per quarter had to pay a higher charge. This was a concession which was decidedly in favour of the small consumer; but, notwithstanding this liberality, very little progress was made. In 1877, it was estimated that the consumption per meter in the small houses would be so inconsiderable that it could only be supplied at a loss; and the Gas Committee, who had once more had the matter before them, abstained from making any special effort to enlarge the scope of their business in those tenements. Matters remained in abeyance until about six years ago, when, as the result of a discussion in the Town Council, careful inquiries were made as to the practicability of increasing the supply of gas to the better class of small houses. The Committee came to the conclusion that it would be desirable to extend the convenience of gas lighting to such houses; but they also recognized that, in justice to other consumers, they must act impartially, and strictly on commercial lines. By way of experiment, seven streets were selected at random in different parts of the suburbs; and an inspection revealed the fact that, of the 400 dwelling-houses fronting the streets or in the open terraces, not more than 100 of the householders used gas, although supply-pipes had been provided by the landlords to about 200 houses. This clearly showed that, before anything else could be done, it would be necessary to persuade the tenants of the houses already supplied with pipes to use the gas, and also to induce the landlords of the other houses to put in fittings. Another difficulty, however, then arose in the discovery by the Committee that many of their own workmen who resided in houses fitted with pipes used oil as an illuminant, because they found in their household economy that it was easier to pay weekly for oil than quarterly for gas; and consequently it became apparent that a weekly collection must be instituted if the system for supplying these small houses with gas were to be at all a success.

About this time, the first form of prepayment meter made its appearance; but by 1891, the automatic or coin-freed meter had been invented. An experiment was then tried in twenty-six artizans' dwellings in Ryder Street (the erection of which had been undertaken by the Corporation); but it was not altogether an encouraging success, because the cost of the weekly collection was more than sufficient to swallow up any profit that could be made. Concurrently with the experiment, similar meters were fixed in fifteen private houses, for which the landlord had hitherto paid quarterly for the gas consumed by his tenants through ordinary meters, and had charged them a weekly sum for the supply. A change of meter in these fifteen houses was beneficial for nine tenants, who effected a considerable economy in their consumption of gas. In view of a further trial, the arrangement was made that, instead of the money being collected weekly by special officers, it should be paid in the rent by the tenants under the Corporation. But even this system, though operative in reducing the cost of the supply, did not obviate the necessity of frequent examination of the meters by trained inspectors, for the purpose of removing the difficulties which arose principally through the meters being temporarily disabled by coins interrupting the working of the mechanism. The consumers exercised economy in various directions; and in those houses in which not only the permanent fittings had been provided by the Corporation but the tenants' fittings—pendants, brackets, &c.—also, care was taken that the fittings should be supplied with the most modern type of governed burner, so that the consumer might obtain the best light for a penny. Another advantage of the new arrangement was that the consumer could test for himself the accuracy of his own meter. He was told that he had a governed burner consuming 5 cubic feet per hour; and it was easy, therefore, for him to see, when he had paid a penny in advance for 25 cubic feet of gas, that he obtained five hours' light for the payment. One interesting fact revealed during the experiment was that the consumption of gas was smallest in the lowest-rented houses. For instance, in a house rented at 5s. a week, it was found that the consumption was not more than half that in a house let at 7s. 6d. per week.

From 1891 to 1893, the experiment was made in 103 houses erected by the Corporation, and in 63 houses owned by private landlords. The Gas Committee, therefore, had sufficient experience to enable them to arrive at a conclusion as to the value of the system. Two things were apparent—first, that the weekly collection must be dispensed with on account of its cost; and, second, that some further encouragement must be given to the use of gas in order that the consumption per meter might be sufficient to make the supply remunerative. Apart from the provision of the tenants' fittings, the cost of which was included in the charge for gas, the capital outlay on the installation could not be less than £3; while, under the most economical arrangements, it was probable that the cost of collecting the pence and supervising the meters, bookkeeping, &c., would involve an additional 6s. or 7s. per annum. Having arrived at this conclusion, it was necessary to do something to increase the consumption per meter. Inquiries made in other towns showed that the supply of the "penny-in-the-slot" meters had led in nearly all cases to a demand for gas for heating purposes—either a small boiling-stove or, as in a large number of cases, a small cooker. In fact, the experience of the larger houses was repeated in the smaller. Consumers having gas in their houses—especially in those where early breakfasts had to be provided and midday cooking had to be done in the living-room—were quick to appreciate the advantages of the use of gas for cooking purposes, particularly in the summer months, when it would obviate the necessity of a fire throughout the day.

Although the Gas Committee had hesitated in the first place to include boiling-stoves in their "penny-in-the-slot" arrangement, they were convinced by the experience of other towns that it was a necessary part of the system, and would solve the difficulty as to the minimum consumption required to make it pay. With regard to the weekly collection, this difficulty was overcome by the meters being made sufficiently large to receive the coins necessary for a whole month's consumption or even a longer period. Of course, there are still some difficulties to be surmounted before the scheme is perfect. The department has made it one of the conditions of supply that the consumer shall, at each monthly collection, pay the difference, if any, between the consumption registered in measures of 25 feet, and that registered on the ordinary index of the meter; or if the difference is in his favour, the balance shall be returned to him. This difficulty is materially reduced by the provision of a supplementary index on the meter showing the number of pence deposited; so that the consumer can not only check the inspector as to the quantity of gas burned, but as to the amount of the pence taken from the box. It is interesting to note that, during the four years the new system has been in operation in Birmingham, there has only been one case of attempted fraud, and that was a case in which a workman, in temporary possession of a house, endeavoured to get a supply of gas by means of a metal disc. It may be a piece of useful information to anyone else who thinks he can impose on the department in a similar manner to say that in the case alluded to the metal disc was rejected by the meter.

More than 1000 meters were fitted in small houses in Birmingham last summer; and the supply since has only been arrested because of the impossibility of employing the fittings staff on the work during the winter. Several hundred applications are on the books; and they will be met as soon as possible. It is expected that, in the light of recent experience, the demand will be much greater during the early spring. The success of the new meter in small houses may, perhaps, ultimately lead gas managers to provide similar fittings for houses of all sizes, because it may be contended that, if the meter is advantageous and economical in a small house, it will be in a large one. This contention will be supported by the fact that no complaints have been received about the quality of the gas supplied under the new conditions, and that, when the burner fails, it is the duty of the department to renew it. It may further be found possible to use the meters in manufactories, where the waste of gas would be prevented, and a check put upon the workmen, by the prepayment system. Mistresses who keep a staff of servants may also discover its utility in the kitchen, just as the housewife does in a small tenement.

GAS CONSUMPTION IN BIRMINGHAM.

Some Interesting Figures.

The working week of the Gas Department of the Birmingham Corporation closes on Thursday; and during the week ending on the 19th ult., the total output of gas from the four works of the Birmingham Corporation—viz., Windsor Street, Saltley, Adderley Street, and Swan Village—was no less than 147,482,000 cubic feet, the greatest amount on record for any one week. In the corresponding week of 1894, ended Dec. 20, the output was 134,299,000 cubic feet, or an increase for the week ending Dec. 19 last of 13,183,000 cubic feet. These weeks did not contain the shortest day and longest night. But in 1891 the departmental week ended on Dec. 24; and therefore did include that particular period. Strange to say, that is the only week in which the output at all approaches that of the seven days ended on the 19th ult. In 1891, the total reached 144,402,000 cubic feet; and this remained the record for any one week until nearly the close of the past year, when, even without the advantage of the shortest day and longest night, it was beaten during the week named by 3,080,000 cubic feet. This increase, however (says the "Birmingham Post," from which this information is derived), is more remarkable than appears at first sight, because of the comparatively mild weather which prevailed in the week before Christmas; and it denotes a very active condition of trade—a fact which is rendered more apparent when it is stated that during the week complaints were made to the department by certain manufacturers using gas in large quantities that the supply was not equal to their requirements. These complaints came from districts in which the demand has outgrown the capacity of the mains; and no doubt the result will be an enlargement of the mains in the spring. Upwards of 15,500 tons of coal were carbonized to produce the 147,482,000 cubic feet of gas; and the coke made for sale from this large quantity of coal was 5891 tons, of which total 5434 tons were loaded and sold during the same week, and only 457 tons placed in stock. In the corresponding week of last year, more than 1000 tons of coke were stocked. The department expect to have in stock at this time of the year something like 6000 tons of coke; but during the week ended the 19th ult., they had in stock only about 1800 tons, nearly the whole of which was sold, and would have been delivered, but for the scarcity of railway waggons.

The Proposed Acquisition of the Shoreham Water-Works by the Brighton Corporation.—At a meeting held on Monday last week, the burgesses of Brighton gave the necessary consent to the Bill promoted by the Corporation for obtaining power to acquire the undertaking of the Shoreham Water Company.

TEIGNMOUTH GAS SUPPLY.

The Deficiency on the Gas Account.

Further discussion took place at the meeting of the Teignmouth District Council on Tuesday last respecting the deficiency on the gas account, to which reference was made in the "JOURNAL" of the 3rd ult. (p. 1160). Mr. Jarvis now asked Mr. F. Wheatley whether he intended to move that the price of gas be increased, as he announced at the previous meeting. Mr. Wheatley said the Gas Committee had the question under consideration for a very long time at their meeting on the previous day; and he was told that it would be further considered on the next occasion, and a balance-sheet be produced. The Chairman (Mr. T. W. Hutchings) said something definite would be brought forward at the next Council meeting; and in view of this, Mr. Wheatley was induced not to press the matter. Mr. Jarvis said they had had promises of a similar kind before. It was time they forced the question of the gas account; and the only way to do it, so far as he could see, was to raise the price of gas. If the deficiency were in another department, they would increase the rates. The longer they went on as at present, the deeper they got into the mire. It would be better to admit that they were "in a mess," and get out of it. A good deal of money was owing on the gas account, and they could not pay. The Chairman remarked that the bills had been presented. Mr. Jarvis said lots of bills had been presented, but not paid. The Committee met once a month, and just looked over the bills, saying which should be paid, and which thrown aside. The Chairman said it was all very well for members to complain; but it would be far better if they would suggest a remedy. The proposal of Mr. Jarvis would, if adopted, make things worse instead of better; and they would lose more than they gained by it. The gas-works were started without capital; and the Committee were obliged to run into debt one quarter to provide for the next. If they could clear off the existing liabilities by March, they would be £1000 in debt again. It had always been so since he had been on the Board. It would be unjust to the private consumers to raise the price in order to enable them to get a working capital of £1400; and it would be a false step, because it would reduce the consumption. They were really making a very good profit out of the private consumers. Four years ago, £150 a year was taken off the price paid for public lighting; so that the district had in four years benefited to the amount of £600. The Clerk would lay a statement of accounts before the next meeting; but they would never be out of debt so long as they were a Council. Mr. Jarvis suggested the advisability of filing a petition. Mr. H. England thought the desired effect might be produced by lowering the price to private consumers, and so encouraging a larger consumption. Other towns started gas-works without capital in the same way that they had done at Teignmouth; and yet they had considerable balances. The Chairman remarked that the gas-works really did not belong to the town, but to the mortgagees, and the Council were simply the managers. Mr. England said this was a mere subterfuge; the works were, of course, the property of the ratepayers. The Chairman replied that, however it was put, the fact was that they had £10,000 borrowed capital on the gas-works, and the only interest which the Council had in them was as to the value above the mortgage debt. Mr. F. Slocombe thought the mistake was that the Gas Committee did not produce an account showing just how they stood. If it was necessary to raise the price of gas, the increase would be granted. Mr. W. B. Harris said the total liabilities at present amounted to £1754. The whole of the finances of the Council were thrown into confusion by the necessity of keeping a balance on other accounts to meet overdrafts on the gas account. Members of the Finance Committee knew the number of threatening letters received in connection with the bills unpaid on gas account. They were charged something like 5 per cent. interest on accounts overdue. They used to obtain a discount on their coal bills; but now something like £600 was owing for coal. It was not right to say the Gas Committee did not present regular accounts, because a balance-sheet had been produced every year until the present; and every quarter a statement of the position of affairs was submitted. The subject then dropped.

ROCHDALE CORPORATION GAS AND WATER UNDERTAKINGS.

The retrospect of the year's doings in the borough which it is the custom of the "Rochdale Observer" to publish at this season is, as a rule, very interesting, and generally contains some up-to-date information concerning the gas and water undertakings of the Corporation. This applies to the record of the year's work which appeared in the last issue of our contemporary in December. Of the gas-works, it says that the past year has witnessed the completion of the greater part of the scheme of extensions commenced in 1893; and the continued increase in the consumption of gas for all purposes has justified the expenditure incurred. The quantity of gas made reached 15 million cubic feet during the preceding week; and this represents the maximum output of which the older portion of the works was capable. Rather more than one-third of the number of retorts in this portion, however, have not been used at all this winter, but the inclined retorts in the new house have been brought into use instead; and 90 of these, out of 120, are now in daily operation. The new workshops are approaching completion; and the old block of buildings used as stores has been removed and rebuilt to afford more yard room for the storage of coke from the new retorts. There still remain the alteration to the boiler-house, and the re-setting of the boilers, as well as the paving of the yard space, to complete the works for which the loan of £65,000 was sanctioned. Our contemporary has been assured that the whole of this work will be completed without exceeding the original estimate. The increase in the quantity of gas made during the year amounts to about 15 million cubic feet, although the state of trade has not been such as to create any exceptional demand. But it may safely be asserted that at least 15 per cent. of the total quantity of gas sold is consumed for purposes other than lighting. The price of gas was reduced from March 25 last to the figure at which it stood previous to the coal trade dispute. Favourable contracts were made for the supply of coal; but the prices of sulphate of ammonia and coke have been so low during the year that the saving under this head will have entirely disappeared, and therefore the Committee must look to the increased consumption of gas for any contribution towards the loss of revenue occasioned by the reduction in price. On the 21st ult., the year was fittingly closed by the entertainment of the workmen and their recognition of the sympathetic consideration of the able Manager (Mr. T. B. Ball), as noticed in the "JOURNAL" last week. In connection with the water-works, our contemporary remarks that it will be satisfactory to the ratepayers to know that progress continues to be made in reducing the deficiency which has for years been such an incubus on the rates. In his last annual report, the Borough Treasurer remarked that "the improvement in the water-works revenue account, although not all that was wished for, has been as much as could be reasonably expected considering the extraordinary difficulties encountered during the severe and prolonged frost." In the financial year ending March, 1894, the net deficiency which became a charge on the rates was £7090; in the year ended March, 1895, it was only £6899. The reduction appears slight; but, of course, its comparative smallness is explained by the year's extraordinary expenditure on repairs, which is scarcely likely to occur again at once. The Water Committee continue their policy of "nursing" the revenue, and reducing expenditure so far as is consistent with maintaining the efficiency of the service. It can be said that, taking the whole period of the existence of the new reservoirs, the deficiency has been far more rapidly reduced than was ever anticipated. There has been such a large demand for new supplies during the past nine months that the Committee expect to close their year in March with a thoroughly satisfactory balance-sheet.

GENERAL GAS LIGHTING AND HEATING COMPANY OF BRUSSELS.

According to the report presented to the shareholders of this Company at their meeting on the 19th ult., the profits realized in the past financial year amounted to 2,523,694 frs., as compared with 2,299,262 frs. in 1893-4. Deducting therefrom the sinking fund and other charges, there was a disposable balance of 1,070,705 frs. After paying the statutory dividend of 25 frs. per share, and making certain allowances to the Directors and chief officers, a final dividend of 17 frs. 50 c. per share was declared; making 42 frs 50 c. per share, or at the rate of 8½ per cent., and leaving 20,950 frs. to be carried forward. In the preceding year, the dividend was at the rate of 7·8 per cent.; and the balance remaining amounted to 10,436 frs. It will thus be seen that the Company have been doing very well. They have now a total length of 791,733 metres, or about 870,000 yards, of mains laid; and from them are served 18,625 consumers (using 244,554 lights), 14,105 public lamps, 12,589 gas-stoves, and gas-engines to the total of 1140-horse power. The quantity of gas sold in the twelve months covered by the report was 25,070,566 cubic metres (about 885 million cubic feet), as compared with 24,039,929 cubic metres in the previous year. The increase in the sale of gas was to the extent of 1,030,637 cubic metres; and the profits were higher by 76,252 frs. The Company have gas-works of their own in twenty towns; and they have substantial holdings in the Companies supplying Carcassonne and Lisbon. In the first-named place, the profits realized were about the same as before; but in the latter, the Company, which is an amalgamation of the gas and electric light undertakings, declared an increased dividend of 2 per cent.—making 5 per cent. The concession at Cambrai has been extended by 40 years; and a concession for 36 years has been obtained at Glageon, near Fourmies.

THE USE OF GAS AND ELECTRICITY FOR LIGHTING PURPOSES IN BERLIN.

Berlin, says "Engineering," is probably one of the best lighted cities in Europe; and its consumption of both gas and electricity is far above the average. The central electric stations, according to recent statistics, supplied electricity for 5673 arc lamps, 121,000 incandescent lamps, and 667 motors, and the annual consumption of gas is 102 million cubic metres. The craving for "more light" is not by any means satisfied; and the lighting installations go on extending. The lighting of the streets by gas dates from 1826; so that Berlin was some thirty years behind England, and nine years behind Paris. It was an English Company—the Imperial Continental Gas Association—which from Jan. 1, 1826, took over the street lighting for a period of twenty-one years—both gas and oil lamps being used. At the expiration of this term, the town itself took the lighting in hand; and no trouble has especially during the last thirty years, been spared to keep the lighting of Berlin to the front. Siemens regenerative gas-lamps have been extensively adopted; so have other powerful lamps, including a number of Auer burners. Berlin (which now boasts about 1,725,000 inhabitants) is lighted by 25,332 gas-lamps. Of these, 18,725 are ordinary burners, 6003 are Bray burners, 55 Auer burners, and 549 Siemens lamps. The aggregate consumption of gas is 17,167,883 cubic metres, entailing an expenditure of 2,490,000 marks, or about £125,000. Berlin has five gas-works, with 3005 retorts and 21 gasholders. The number of petroleum lamps for street lighting is about 1200. The use of electric street lights dates from 1880, when Messrs. Siemens and Halske installed some lights by way of a test. The authorities were not by any means in favour of electric light; but their objections were overcome, and in 1882 one or two of the principal thoroughfares were lighted by electricity. Six years later, a great move was made; the electric light being adopted for some of the most important streets and places. Berlin has now five central electric stations, in addition to which there are some 300 private installations. This brings up the number of lamps to 10,537 arc and 203,532 incandescent.

THE AMALGAMATED WATER-GAS COMPANIES, LIMITED.

The Ordinary General Meeting of this Company was held at the Great Northern Hotel, Leeds, last Tuesday—Mr. SAMSON FOX in the chair.

The annual report, the principal portions of which were given in the "JOURNAL" last week, having been presented, together with the financial statement,

The CHAIRMAN moved their adoption. In doing so, he remarked that, though the financial position of the Company was not a cheering one, there were reasons, as was explained in the report, for the condition in which the shareholders found themselves. A considerable sum of money had had to be spent in meeting the actions of irresponsible persons, who, in every instance, lost their case. The Directors had done their best to avert loss. But they felt it would not be right to go into active business as an Amalgamated Company with their debts surrounding them; and consequently they had done very little business. However, while they had been at rest, others had taken advantage of what they had done in demonstrating the value of water gas; and to-day there was a very large make of it in the country, and also of apparatus for producing it. Other companies made water gas for lighting purposes; but he believed none but the Amalgamated Companies were able to apply it to metallurgical purposes, as their patents had still a long time to run. He was satisfied that the world was better prepared to-day for the adoption of water gas, almost in any sphere, than it was when they started the business. The patents belonging to the Company admitted, in his opinion and in that of others, of a good business being done. It had often been said that their system of water gas had collapsed, and that it was not adopted or used. But he could assure the shareholders that it played a more important part in many processes than it did when the business was begun, or when he last addressed them. The advantages of water gas had been proved. It had been said that at the Leeds Forge it was only used on show days. A few days previously he took out the figures; and he found that at those works 70,000 tons of steel had been manufactured with water gas. (The Chairman also mentioned other Companies—the Lancaster Waggon Company; Clough's, of Keighley; Moss Bros., of Eastwood; and Messrs. Stewart and Clydesdale, of Coatbridge—who had used water gas successfully.) The great difficulty had been dissension among themselves. This difficulty had been so great that, if he had not seen in water gas a profitable business, he would not have continued his connection with it from the beginning until now. It would be a great mistake to let it go, and allow others to reap the benefits of it. During the past twelve months, he had been making experiments with acetylene gas at his house and at the Leeds Forge. It possessed 15 or 16 times more illuminating power than coal gas, and could be used for lighting a country house for less money than the cheapest coal gas known. He believed that there were great possibilities in the new gas, and that it would be of considerable help to the water-gas companies. His wish was to help those companies; and when he had completed his investigations, he would offer to allow them to make their own investigations, and take it for what it was worth. The Board hoped in a couple of months to be able to suggest something definite in the shape of an additional shilling or two per share, to put the concern into a healthy condition.

Mr. T. PROCTER (a Director) seconded the motion. He said he had a large interest at stake in water gas, for which he thought there was a future. They had had a very hard time to go through, but he thought the sky was brightening.

The report and accounts were adopted.

Mr. Fox, Mr. Procter, and Mr. Worth (the Managing Director) consented to be Directors until the extraordinary meeting, which it is intended to call within the next two or three months, to decide the question of further capital; it being understood that the Directors will then resign. Mr. J. Gordon, jun., was re-appointed Auditor for the same period.

A vote of thanks was then accorded to the Chairman, and the proceedings closed.

NORTHERN COUNTIES HYDRO-OXYGEN GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Tuesday, when the following report was presented:—

The Directors regret to report that they have not made any progress this year in the extension of their system of gas enrichment; but they have hopes that the results of the steady and advantageous working at the Huddersfield Corporation Gas-Works willeventually lead to its adoption in other great centres. No exertion has been spared to forward the business of the Company; but naturally we have had to wait the full results of the Huddersfield working.

So far as the experience of the working of our system at the Huddersfield Corporation Gas-Works is concerned, we have to report an unqualified success. Your Directors have pleasure in giving below the particulars of the cost of the carbonization of coal and cannel as against coal and oxy-oil enrichment, taken from the published accounts of the Corporation, which, on perusal, you will find more than confirm our most sanguine anticipations.

The following calculations are based upon an average output of 437,500,000 cubic feet each year:—

Comparison of Carbonization Account (i.e., Coal Enrichment and Cost of Labour.)

For year ending March 31, 1893, 437,500,000 cubic feet coal and cannel enrichment cost	£49,204
For year ending March 31, 1894, 437,500,000 cubic feet coal and partial oxy-oil enrichment cost . .	44,430
Showing a saving through partial enrichment by oxy-oil of	£4,774
For year ending March 31, 1895, 437,500,000 cubic feet coal and all oxy-oil enrichment, cost £37,774; showing a saving over all cannel enrichment of .	£11,430

In November, 1892, with the old system of retorts and about 50 per cent. of cannel, the illuminating power was 17·29 candles. The cost for carbonization per 1000 cubic feet was practically 2s. 3d. In November, 1895, with oxy-oil enrichment, and the improvements of the works, the illuminating power was 18·59 candles; the cost for carbonization per 1000 cubic feet being reduced to 1s. 8¾d.

It is a matter of great satisfaction to be able to report such large savings being almost wholly attributable to oxy-oil enrichment.

The Huddersfield Corporation have thus been more than repaid, from the first full year's working, for the entire cost of the oxy-oil gas enrichment plant. We have every confidence that when practical results of such a satisfactory nature become thoroughly known in the gas world, we shall soon have further installations at work.

Your process has been working under great disadvantages at Huddersfield, in consequence of the almost entire reconstruction of the works, which has been going on ever since its introduction, and has led to its being blamed (by those ignorant of the process) for irregularities resulting from totally different causes.

These disadvantages, however, only prove to a greater degree the reliability and economy of your process, which we confidently assert will ere long revolutionize gas enrichment, and keep it abreast of any other system of illumination.

ELECTRIC AND INCANDESCENT GAS LIGHTING AT TUNBRIDGE WELLS.

In the course of the proceedings at the meeting of the Tunbridge Wells Town Council last Wednesday, it transpired that the action of Alderman Cronk (who occupies the positions of Chairman of the Technical Institute and a Director of the Tunbridge Wells Gas Company), in having the electric light installed in the Art Room of the Institute, had given rise to a great deal of criticism. Curiously enough, the critics are not to be found in the ranks of the shareholders of the Gas Company, but among those who are concerned for the future of the electric light. These parties have fastened upon a statement made by Alderman Cronk in respect of incandescent gas-lamps, in answer to a question put to him as to why the Art Room was fitted up with the electric light. He said the question of having light in the room was a serious one; and as the cost of the electric light was less than £5, he thought it might reasonably be left to the discretion of the Committee to do the work at once, as the classes were going on without proper light. The Committee had put incandescent gas-burners in the other rooms; but in the Art Room they could not do this, as they wanted a central light which would not cast shadows. Nine new incandescent gas-burners had been put up in the Institute; four of them being given by the Gas Company. The consumption of gas had not been tested, because it was thought everyone knew that the consumption of incandescent gas-burners was less than that of the other kinds. An anonymous individual, who signs himself "An Electrical Engineer," has accused Alderman Cronk of furthering the gas interests on the Council; and he challenges him to produce a standard gas-burner and an incandescent gas-burner and prove his statement as to consumption. He questions if the Gas Company would give away burners worth 15s. in order that less gas might be consumed. Alderman Cronk considered this an ungenerous attack; but he informed his colleagues in the Council that his experience of the incandescent gas-burner was that, whereas in one of his own sitting-rooms he formerly found it necessary to use three governor burners, he now had one incandescent burner only, getting an equal quantity of light therefrom, with the comfort of an improved temperature, and a decreased consumption of gas to the extent of nearly 70 per cent. This matter has given rise to much comment and newspaper correspondence; the writer of one letter being Mr. L. de Fonblanque, the Secretary of the Incandescent Gas-Light Company, Limited. He twits the "Electrical Engineer" for his confession of ignorance as to the consumption of gas by an incandescent burner; and he adds: "Perhaps it will be a bitter awakening to 'Electrical Engineer' to learn that a Welsbach incandescent gas-light burner, consuming 3½ cubic feet of gas per hour, gives a light of over 50-candle power—that is to say, about 14-candle power per cubic foot of gas. The standard—viz., the 'London' Argand burner, consuming 5 cubic feet of gas per hour—gives a light of 16 candles, or 3¼ candles per cubic foot of gas. That is to say that an incandescent gas-light burner consumes one-quarter the amount of gas of an ordinary burner for the same amount of light; and if 'Electrical Engineer' has any doubts whatever on this point, I shall be very pleased to convert him by the testimony of a test meter and a photometer."

ELECTRIC LIGHTING NOTES.

More complaints were made by members of the Hampstead Vestry last Thursday as to the peculiar attributes of their electric light. Mr. Evans ingenuously asked the Electrical Engineer for the reason of the sudden stoppage of the current on the previous Sunday and also on Christmas Eve. He (Mr. Evans) thought this illuminant was very uncertain, and not to be relied upon. The Engineer was understood to say that his employees were at the time putting on a new cable; and "unfortunately did not notice," &c., &c. Mr. Elliott pointed out that this erratic conduct on the part of the current was a serious detriment to business in the High Street, for his own premises were without light for ten minutes, and a neighbouring publican was similarly situated. Besides, added Mr. Elliott, his own foreman had appealed to him to have gas laid on again. Mr. Hardcastle thought it would be wise, now that the subject of complaints was being discussed, if the Vestry ordered a letter from Messrs. Dellagana and Co., the electrotypers, to be read. According to the digest of the letter supplied on the *agenda*, the firm complained "that their electric light was discontinued without notice, and consequently a number of their negatives

and plates were spoiled, for which they asked compensation." Other members supported Mr. Hardcastle in his request. The Chairman (Major-General Young), however, reminded the Vestry that the matter was already being dealt with by the Electric Lighting Committee; and it would, he said, be very unusual for the Vestry to discuss it without consulting them. Mr. Hanhart inquired whether the Committee were considering the matter on their own initiative, or whether the Vestry had referred the letter to them. The Vestry Clerk here interposed with the remark that, as a matter of urgency, he had submitted it to the Committee during the recess; and he assured the Vestry that the occurrence was "purely accidental and quite unforeseen and unavoidable." This plausible explanation did not satisfy Mr. Hanhart; and he accordingly moved that the letter be read. Mr. Aitcheson could not see the necessity for this; but Mr. Farmer raised a storm about his ears by suggesting that these attempts at suppression of the facts looked very suspicious, and would not be relished by the public. The Chairman protested that this was a thing no member of the Vestry ought to say. He ultimately admitted that he must put the resolution, which, if passed, would, he said, be a decided slur on the Committee. The motion was eventually lost; and so the interesting details of this, the latest, *contretemps* are temporarily postponed.

Before launching out into a scheme of electric lighting, the Yeadon District Council took the sensible course of canvassing likely customers to ascertain the amount of support they could depend upon. Voting-papers to the number of 263 were returned; and of these 154 were blank, 76 were against the adoption of the light, and only 33 favourable. The 33 would-be customers promised to take up between them 172 lights; but the canvass is considered so "decidedly unfavourable" that the Council have determined to drop the scheme.

Opinion is still greatly divided in Torquay as to the advisability of the Corporation's proposed electric lighting experiment. Mr. W. H. Trentham, the Electrical Engineer, whose advice the Town Council have now sought, met the Electric Lighting Committee last week, and visited various sites suggested for the generating station. Mr. Trentham is reported to have said that he did not anticipate any inconvenience from the adoption of the Bath Saloons site, which had been previously recommended, but with reference to which strong opposition is probable both within and outside the Council. It was, however, decided that Mr. Trentham and the Borough Surveyor, with some members of the Committee, should visit certain alternative sites, including the Corporation Yard, Market Street. It was also suggested that the Corporation quarry at the back of Market Street should be used as the site of the proposed refuse destructor; and that, in connection with it, arrangements should be made for raising steam to drive the dynamos. There are numerous dwelling-houses in close proximity to the newly-suggested sites; but it is reported that this is not considered a serious objection. When he has concluded his investigations, Mr. Trentham will prepare and submit to the Council another report and estimate. There will probably be opposition to the scheme in any event, as there is a feeling against incurring further expenditure on an undertaking the success of which is problematical.

An unexpected difficulty has arisen in connection with the electric lighting scheme of the Wimbledon District Council, to which several references have been made in the "JOURNAL." We do not for a moment believe that the inhabitants want the electric light; for, when the matter came before a public meeting held in the Drill Hall, only eleven hands were put up in support of it, while something like eight times the number appeared against it. This result was probably owing to the spirited action of a ratepayer, who circularized the inhabitants on the question, and put before them a very common-sense view of it. However, the Council went on, and an inquiry was held by Major-General Phipps-Carey, into the application to the Local Government Board for sanction to borrow £32,000 to carry out the scheme. The Inspector duly made his report; and at the meeting of the Council last Wednesday, a communication from the Board thereon was read. It was to the effect that, in view of the early expiration of the Wimbledon Electric Lighting Licence, 1889, the Board would not be in a position to sanction a loan for any period longer than the unexpired term of that Licence. If, therefore, the District Council were desirous of carrying out the scheme by means of borrowed money, of which the repayment was to be spread over an extended period, the matter must stand over until the Council were in a position to show that they had obtained renewed powers extending over a corresponding period. This was crushing! The Chairman (Mr. A. Holland) remarked that, as their Licence would expire next October, it would be manifestly absurd to attempt to raise the money to be repaid in that very short time. Two courses were open to them. They could go in for an extended Licence, and, if that were refused, apply for a Provisional Order as most other districts had done. The worst of this was that the necessary notices could not be served in time for the next session of Parliament, but would have to be held over till Nov. 30 next, and then they would probably obtain an Order in 1897. This, of course, would postpone the matter fully twelve months longer than they had anticipated. The only question was whether it would be prudent to set to work and get something done in advance, so as to be ready to push the works farther on when they had obtained the Order; for he took it there could be no doubt that their application would be granted. The Clerk said he understood it was not the practice now to grant Licences, but to require Provisional Orders in every case. The authorities, however, might be willing to grant a short Licence, just to give time to obtain an Order. But, in view of the Board's letter, he was not quite sure that this would do much good, because if they obtained an extension for a couple of years, he was afraid the Board would not grant the Council the loan for that time. Eventually, it was decided that the Chairman and the Clerk should see the officials of the Local Government Board on the matter. Whatever may be the result of the interview, it seems pretty certain that there will be no electric lighting scheme carried out this year at Wimbledon.

A strong and representative deputation attended the meeting of the Swansea Town Council on Monday last week, to give expression to their views on the electric schemes now before the Council. The party, which included many of the leading inhabitants of the town, was headed by Dr. T. D. Griffiths. After much discussion as to the question of hearing the deputation, inasmuch as notice of their intention to attend did not appear on the *agenda*, it was decided to hear three members. Dr. Griffiths said the deputation had attended to express their opinion of the triple scheme which had been under the consideration of the Corporation for some time past—a scheme which combined a refuse destructor, an electric lighting station, and the electric driving of the tramcars of the town. The deputation saw that there were many objections to the scheme as a whole, every section of which depended on the other. The Council seemed to have been convinced that the scheme was useful, economical, and profitable. But their Consulting Engineer (Mr. E. Manville) had recently read a paper on the subject, with the result that the public had obtained the opinions of the leading electrical engineers of the country thereon; and they seemed to very much question the possibility of the scheme being successfully worked. No doubt it was a very dazzling one. Mr. Manville said electricity could be profitably supplied at 1½d. per unit; whereas experience showed that from 6d. to 8d. was the profitable price. Now, the saving was so extraordinary that, if this could be effected, electricity would be very much cheaper than gas. But let them take gas for example. Ordinary 16-candle gas burnt for 1000 hours consumed 5000 cubic feet, which would cost 15s.; whereas electricity at 6d. per unit (16-candle power) would cost 30s. On the other hand, the incandescent gas-light cost 10s. 6d., with three times more light than either of the others. Mr. Manville said he could supply electricity at 1½d. per unit; and he said he could save 2d. per unit. But in the discussion on his paper, it was proved that, even if every bit of refuse was consumed, all he could possibly save was ⅜d. This was not disproved; and still the scheme providing for the profitable supply of electricity to the Tramway Company at 1½d. per unit was presented to the ratepayers of Swansea. He (Dr. Griffiths) suggested that, if they undertook the scheme, and then found they could not supply electricity at (say) the small sum of 3½d. per unit for a million units, which amounted to £8500 a year (and he thought engineers would agree that it could not be supplied for less), and if they still agreed to supply the Tramway Company at 1½d. per unit, they would do so at a loss of £2500 a year. If Mr. Manville's figures should, nevertheless, prove true, then all he could say was that the refuse of the town of Swansea would become a commodity worth £6000 a year, and any manufacturer in the neighbourhood would be glad to utilize it. But what would manufacturers say if anyone made such a suggestion? They would simply laugh at it. Mr. Manville said his triple scheme had never been tried anywhere till now; and even at Shoreditch, where a double scheme was to be tried on Mr. Manville's lines, the conditions were that if it were not a success the contractor would not be paid. He (Dr. Griffiths) compared the different characters of the stuff to be destroyed, and asked if Mr. Manville had tested the refuse of Swansea. In conclusion, he calculated the cost of these schemes at about £200,000, and begged the Corporation not to launch in a precipitate manner on these uncertain projects without some security. He warned the Council that the ratepayers in one of the most heavily-rated towns of the kingdom had the final voice in the matter, and that they would make that voice heard. Mr. A. Sinclair, an electrical engineer, followed. He endeavoured to prove that an electric high-tension scheme, or any other Christmas novelty which might be introduced, could not be used for driving tramcars. He read an extract from Mr. Manville's paper, which, he maintained, proved that, after supplying the electric light, there would be only 50-horse power to spare on his own figures, whereas it required 230-horse power to run the tramcars; and the question was where they were going to get it from. The fact of having only 50-horse power to spare out of the 230 required, knocked the whole bottom out of the scheme. The members of the deputation then retired. A motion was thereupon submitted empowering the Corporation to proceed with their Bill for the acquisition of the tramways and working them by electricity; and it was agreed to with only six dissentients.

TAR AND AMMONIA PRODUCTS IN THE PAST YEAR.

In their review of trade in the past year, the "Chemical Trade Journal" for Saturday last made the following remarks on tar and ammonia products:—

In reviewing this industry, it has previously been necessary to deplore the condition of the tar products, and to seek consolation in the position of sulphate of ammonia. It will be seen, however, on looking at the progress during the past year, that the positions have been reversed. Benzols, though they opened rather badly, improved as the year progressed, and are now decidedly strong—fetching good prices for both 90's and 50/90's. It would be a difficult matter to state exactly how far these improvements are due to the efforts of the Tar Products Syndicate. Undoubtedly, their work during the past two years has not been wasted, though, of course, much has depended on the better outlook which has been created by the more extended use of benzol for gas enrichment and kindred purposes. The attempt at a "combine" in Germany, if not finally carried out on the exact lines which characterized its inception, has undoubtedly been productive of good rather than the reverse. Carbolic acids have been fairly steady, particularly 60 per cent. crude. There was little fluctuation in the price during the earlier months of the year; and this steadiness, with the close of 1895, gave place to an advance, particularly for crude, while crystals have followed suit in a proportionate degree. Naphthas, on the whole, have been slow; and there would have been little to say had it not been for the sudden advance which took place in December. The relative values of naphtha and benzol have been somewhat anomalous; and their peculiar position seems to have at last demanded attention, if we may judge by the correspondence which has appeared in those journals which deal prominently with the weekly prices of these products. Whether the outcome of the correspondence will prove to be anything of practical utility is far too problematical a point to be definitely answered at the present moment. Sulphate of ammonia is an article concerning which, in its present position, "the least said is soonest mended;" and we cannot but wish that by saying a "little" we could mend the market. Some *ultra*-pessimists are prone to the belief that at present the "market" is an unknown quantity; but we

think that the statistics of shipments afford the best answer to this somewhat exaggerated view, particularly the figures for the exports to the United States. Unfortunately, the volume of the business is not so important as the monetary values at which the transactions are effected; and on this point it would indeed be hard not to give vent to pessimistic expressions. Prices at the beginning of the year were none too high; and though an improvement set in (£11 8s. 9d. being realized) this price resolved itself into a turning-point, for since the realization of this figure there has been a gradual decline. Prices now approximate closely to what threatens to be the varnishing-point of profits, since the spot value is to-day from £8 10s. to £8 12s. 6d. per ton.

THE WATER QUESTION AT EASTBOURNE.

At a Special Meeting of the Eastbourne Town Council held on Monday last week to discuss the water question, certain important matters cropped up. The Town Clerk (Mr. H. W. Fovargue) reported some correspondence which had taken place with the Water Company; the chief communication being in respect of a complaint by Surgeon-General Ray, who had had a sample of the water supplied to his house analyzed, and forwarded a copy of the report of the Analyst (Mr. J. A. Wanklyn) to the Sanitary Committee. In transmitting the report to the Company, the Town Clerk wrote to the effect that, though they had remained silent for several weeks, this must not be taken to mean that they were satisfied with the water supply, even though it might be, as in fact it was, less hard, and might contain, as it did, less chlorine than at the date of Dr. Frankland's analysis. He added that the Sanitary Committee would be obliged by precise information as to the works now being carried out by the Company with the view of providing a supply of pure and wholesome water to the town, and when such supply might be anticipated. The Secretary of the Company (Mr. F. A. Currey) replied that, having regard to the opinion expressed by Mr. Wanklyn upon the sample of water sent to him, the Directors thought it desirable to submit the report to Dr. Frankland, who advised that, while the water was not satisfactory in all respects, he entirely disagreed with Mr. Wanklyn's statement that it was injurious to health. In reply to the inquiries about the works the Company are carrying out, he stated that they were being pushed forward energetically, and it was hoped that the new supply would be available very shortly. Alderman Strange said it was to be regretted that the Directors had refused to receive a deputation from the Corporation on the water question. But the Council were still desirous of meeting the Directors, if possible; and, in the event of the poll being in favour of the Corporation's Water Bill, the Council would still be willing to meet the Company in the same spirit. He was in favour of acquiring the water-works now, lest by waiting they would have to give more for them. The Corporation were willing to pay a fair price, and would not take any advantage of the Company in their temporary difficulty. He moved that the Company be informed of the willingness of the Corporation to confer with them after the poll had been taken, providing, of course, that it was in favour of the Corporation. Mr. Foran seconded the motion; being hopeful that an arrangement would be come to. With regard to the hardness of the water, it was computed that there was a waste in Eastbourne of more than £2000 a year in soap alone. The Corporation, in their Bill, stated that they wished to soften the water; and they had been told that it would entail enormous expense. This would not be so. It must, of course, be understood that there was a difference between "soft" and "softened" water; for though the former would act upon lead pipes, and bring lead into the water, the latter would not do so. The motion was carried.——Last Wednesday evening, Dr. M'Queen presided over a meeting at Eastbourne, convened for the purpose of supporting the Corporation in their proposal to acquire the water-works. A resolution in favour of the scheme was carried.

The Public Lighting of Burnham-on-Crouch.—The parish of Burnham-on-Crouch, Essex, is in a strange predicament with reference to its public lighting. Five years ago, the Lighting and Watch Act was adopted for part of the parish; and the streets have been lighted ever since. Doubts have recently been raised as to whether the Act was legally adopted; and the Parish Council, to settle the matter, obtained an opinion from Mr. A. MacMorran, barrister. This gentleman has decided that, owing to the neglect of certain formalities, the Act has never been properly adopted, and that the parish is in the position of one that has never been lighted. At a parish meeting held a few days ago, a resolution was carried adopting the Act for the whole parish. A poll was demanded. A majority of two-thirds is required to adopt the Act; and should this not be obtained, the lighting of the streets will cease, and a question will then arise as to who is to pay the gas bill for the last three months.

Torquay Water Supply.—Further proposals for dealing with the water supply of Torquay are under consideration. Hitherto the Water Committee have been in favour of the purchase of the drainage area of the Tottiford and Kennick reservoirs, with the view of increasing the storage and abandoning the supply from the Trenchford stream, which has been held to be, if not actually polluted, in danger of pollution from the farms bordering upon it. The Trenchford stream is, however, the largest of the three sources of supply; and though the water is only used in very dry seasons, when the reservoirs are low, the opinion now prevails that it may be most advantageous to acquire this watershed. It is about 900 acres in extent; whereas the area of the Tottiford and Kennick reservoirs, which the Corporation originally proposed to purchase, is 1270 acres. There are, however, seven farms on the Trenchford watershed, and only three on the others; so that the cost of the smaller area would probably be greater than that of the larger area for which the Council were formerly in treaty The Water Committee have instructed a valuer to prepare a statement of the cost of the land; and they will also take Counsel's opinion as to the powers of the Corporation to call upon owners of farms near the reservoirs to prevent pollution of the town's water.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Bailie Pollard, of Edinburgh, has lately been contributing to the "Scotsman" a series of articles on Edinburgh municipal finance. He brings out that during the past sixteen years, on account of the operation of the burgh, poor, and school authorities, there has been an augmentation of assessments to the amount of about 5d. in the pound, but that the solace for the extra burden is to be found in the charges for water and gas supplies. The water-rate is per £1; and as there has been a reduction of 2d., the net increase upon the assessments, so far, is about 3d. per £1. But with regard to the gas supply, he points out that sixteen years ago it was charged for at the rate of 4s. 2d. per 1000 cubic feet. Eight years ago the Corporation took the service into their own hands; and the price of gas is now 3s. per 1000 cubic feet. In addition, the Corporation have abolished meter-rents. He goes on to say: "The abolition of the meter-rent was itself an instant relief to every householder who used gas and paid £10 rent or under, of not less than 3d. per £1. This relief alone would have made up to the great mass of the working-class population of the city their share of excess of taxation already spoken of. But this is not all. If we take from the books of the Gas Commission (say) ten ordinary householders of £10 rent, we find that, on an average, the ten pounder consumed last year 5600 cubic feet of gas. This cost him 18s. 6d. Sixteen years ago, with meter-rent added, it would have cost him £1 5s. 10d.; and ten years ago it would have cost him £1 3s. Or, to come to the better-to-do middle class, if we take ten ordinary £60 householders, it appears that, on an average, each sixty pounder consumed last year 27,100 cubic feet of gas, at a cost of £4 8s. 5d. This, with the addition of meter-rent, would have cost him in 1879-80 £5 15s. 5d.; and in 1884-5 it would have cost £5 1s. 10d. The Gas Commission have been able to effect these reductions not by any financial sleight of hand, but by diligently working at the business placed in their charge, and by scrupulous regard to the obligations imposed upon them as trustees for the public and as employers of labour. Their Act of Parliament obliges them to set apart each year to a sinking fund a sum which, accumulated, will pay off the purchase price within sixty years. They have hitherto more than fulfilled that obligation; and the price will be paid off in less time. . . . . Two instances have been taken, the ten and the sixty pound householder. Larger consumers of gas have proportional advantages. It has been shown that the ten pounder's gas bill is now 18s. 6d., compared with 25s. 10d., or 7s. 4d. less than it would have been sixteen years ago. In other words, on a £10 rent the ratepayer is a gainer to the extent of nearly 9d. (8·8d.) in the pound. Add to this the 2d. by which the Water Trust have relieved him; and we have 10·8d. Deduct the increase of 5¼d. on the school rate; and he remains a lower taxed ratepayer by a good 5¼d. in the pound than he was in 1879-80. For the great body of the working-class population, and for all small ratepayers, surely this is a satisfactory result. In the case of the £60 householders, the difference between £5 15s. 5d. and £4 8s. 5d. gives 27s. of saving on his present gas bill, representing a reduction of 5·4d. in the pound. This meets the excess caused by the school rate; and he is left with a net saving of 2d. in the pound in consequence of the reduction in the water-rate." Reminders like these are sometimes desirable, as people are apt to forget favours they receive, and to remember only the burdens from which they suffer. It is all the more satisfactory to everyone connected with the gas industry to find that the gas undertaking is really the most successfully managed and the most lucrative of all the city departments.

A meeting of the Edinburgh and Leith Gas Commissioners was held on Monday. There was not much business of interest before the Commissioners; but the reports of the Engineers were very gratifying—showing, as they did, a constantly increasing business. The figures submitted were for the month of November and for the period from May 15 to Dec. 9. There was an increase during the month of November of 13,389,000 cubic feet over the output in November, 1894; and for the period from May 15, there was an increase of 36,539,000 cubic feet. During the same period of 1894, there was an increase over the preceding year of 27,202,000 cubic feet. The Commissioners have therefore the greatest reason to be satisfied with the position of their business. It must not be forgotten, too, that during the past seven months—that is a little more than the time covered by this return—the "phenomenally successful" installation of electric lighting has been running as a rival; and thus there is special gratification in the fact that the Commissioners have not only held their position in the face of competition, but have increased their lead. The figures for December were not made up on Monday, there being still two nights' consumption to run; but Bailie Kinloch Anderson intimated that in the month they had had some of the largest makes of gas in any day during the existence of the gas undertakings.

A question about the extinguishing of lights in common-stairs was raised by an instruction given by the Works Committee to the Clerk to write to the Edinburgh Corporation asking them to use their best endeavours to have the lights extinguished at the proper time. To understand this, it is necessary to explain that more than a year ago the Corporation undertook to extinguish the lights, and to collect the charges for the gas consumed; and upon that footing the Commissioners, having a good debtor as well as a certainty that the lights would not be kept burning all day, as they sometimes were when the residents in the stairs were required to extinguish them, agreed to sell the gas at a reduction. I suppose the complaints which have been made have arisen in consequence of the Corporation engaging too few hands for the putting out of the lights, in an endeavour to economize. Mr. John Jamieson thought the instruction by the Clerk was an imputation upon the Corporation. It appeared that surprise visits had been made on behalf of the Commissioners, and that the lights had been found burning after daylight—when, of course, they should have been out. Mr. Linton, under whose charge Leith and the northern part of Edinburgh is, said that in his district only ten lights were found burning over the hour. This about ended the conversation on the subject; but there was general concurrence in an observation by

one member that the Corporation of Edinburgh should be, in that matter, treated the same as a private consumer—which amounts to this, that they should be liable to be prosecuted in the Police Court, if they failed to put the lights out at the proper time.

We are apparently on the eve of a publication which will interest your readers—at least, so I gather from a letter which was read to the Edinburgh and Leith Gas Commissioners. The writer was a lady; and she wrote as follows: "I am interested in finding out the results of municipal undertakings, gas, water, &c.—as compared with those managed by private companies—and would be much obliged if you could let me have some statistics regarding your management in Edinburgh." The Commissioners are not a hide-bound body; and they cheerfully agreed to let her have a copy of their annual financial statement. As I, in turn, like to encourage enterprise, I do not publish her name, lest it should embarrass her in her quest for facts. The subject, I must confess, is rather a heavy one for a lady unaccustomed to such matters to tackle; and if she handles it skilfully, she may not only bring out something interesting, but will make a name for herself.

It is only within the last few years that the Tradeston works of the Glasgow Corporation Gas Commissioners were entirely reconstructed in accordance with modern notions, and very greatly enlarged; and already it has been found necessary to make another important extension. At the last meeting of the Sub-Committee on Gas-Works the Engineer (Mr. W. Foulis) submitted drawings of the proposed extension of the retort-houses in accordance with the plan laid down when the reconstruction of the works was agreed upon; and after due consideration of the proposal and drawings, he was instructed to have the necessary specification for the work prepared. At the same time, the Secretary was authorized to advertise for tenders for its execution. There are three retort-houses; and the new house is to be of the same size as the others. It is to contain 272 retorts; thus making a total of 1018, and completing the plan. Of course, the coal-store is to be correspondingly extended. The plan also embraces another installation of coal-breaking plant, and a couple of charging and drawing machines of the Arrol-Foulis type; so that the new retort-house, will, like the other three, be quite complete in itself. Eventually there will be eight charging and drawing machines at these works, which will be as thoroughly "up to date" as any establishment in the kingdom.

At the suggestion of the Engineer-in-Chief, the Glasgow Corporation Gas Committee have given authority to have certain important extensions of the gas-mains carried out in the Clydebank and Shieldhall districts, at an estimated expenditure of £4000. The district of Clydebank, which is somewhere about six miles from Glasgow, in the direction of Dumbarton, is the seat of several very important industries, and has for a number of years been a Police Burgh. It has received its supply of gas from the Glasgow Gas Commissioners since before the district was incorporated, and at the same price as charged in Glasgow. Messrs. J. and G. Thomson, of the Clydebank Shipyard and Engine Works, had within the yard a gas-works of their own, from which they sent a supply to a number of their workpeople living near; and they consented to give up the manufacture of gas on being assured by the Glasgow Corporation Gas Committee that they would extend their street-mains from Whiteinch and Yoker to Clydebank. At Shieldhall, which is down below Govan, on the other side of the Clyde, there is an immense manufacturing establishment which belongs to the Scottish Co-operative Wholesale Society; and close by, at the river side, there are very extensive premises for receiving and temporarily housing cargoes of foreign cattle. It will thus be seen that the expenditure required for the extensions of the gas-mains is not likely to be an unprofitable outlay of the Gas Trust capital.

The Caledonian Railway Company, being about to open an extensive underground railway in Glasgow, have resolved to erect a large oil-gas works at Maryhill. Two years ago, they erected one in Edinburgh. Before then their gas-lit carriages had their reservoirs replenished from works at Glasgow and Perth; locomotive tanks being employed to convey the gas to outlying terminals, when it was necessary to charge the carriages there. Gas lighting has, however, advanced rapidly; and it has been necessary to increase the number of works. The Company do not seem to have gone in for any attempt to use electric lighting in their carriages. It is announced that the Great North of Scotland Railway Company are about to experiment with a system of electric lighting, which has been tried on one of the railways near London, and in which the current is generated by the rotation of the axles of the carriages, and accumulators keep the light going when the trains are stationary. I think the experiment rather risky for a north country railway company to try. I was myself detained on the Company's line a year ago for several hours, by a snow block. Would the accumulators hold out for an hour or two? If not, what would the plight of the passengers be? Talking of public vehicles, I see that the lighting of the tops of the Glasgow Corporation street-cars by electricity has been, or is being, abandoned. The community feel no regret at its loss. When the evenings are dark in Scotland, the weather is usually too cold to make reading on the outside of a moving conveyance a pleasure; and the streets are sufficiently lighted to allow all other necessary travelling operations to be performed.

Mr. A. Wilson, the newly-appointed Manager of the Perth Corporation Gas-Works, has a pleasing duty to perform on his taking over of his duties, which he has just done. The past year's working of the undertaking, under Mr. Whimster, has been very successful; the output of gas having been 110,343,400 cubic feet, as compared with 102,211,600 cubic feet during 1894—an increase of 8,131,800 cubic feet, or 7·95 per cent. Mr. Whimster must be gratified that he has been able to leave a flourishing business to his youthful successor.

Statistics have been published this week relating to the gas and electricity supplies in Dundee; but they appear to me to be excerpted from the annual reports which were published in June regarding the financial year ending April 30 last; and as such, they possess no new value.

Through the domestic circumstance of information which I had having been overlaid by something, I failed, a month ago, to take notice of an explosion and a fire in the Falkirk Gas-Works. I now hasten to give it. When, in October last, I described the Peebles oil-gas plant which had been erected in the works, I referred to its arrangement as being particularly good for the prevention of fire. It is strange that a fire occurred in connection with it within six weeks afterwards. I am glad to say, however, that the process had nothing to do with it. The occurrence took place in a small building in which is situated the meter for registering the quantity of gas produced from oil. Between it and the retort-house there are two walls, a roadway, the coal-gas condensers, and the exhauster-house; so that oil would not be within about twenty yards of it. A leak in a gas-pipe in the meter-house allowed the gas to saturate the atmosphere of the room, until it was ignited by a gas-jet which was burning. An explosion occurred, which blew out the windows of the house, damaged the roof, and set fire to the woodwork. The Manager (Mr. Watson) and his two sons easily subdued the flames with a mixture of lime and water; and the damage was very small. The occurrence took place at six o'clock in the morning, when it was quite dark, which accounted for the gas being lighted in the place.

The extension of the Renfrew Corporation Gas-Works, to which I referred last week, has been rendered necessary by the large increase in the consumption of gas which has been experienced lately. It is proposed, in the first place, to erect a new gasholder, of from 120,000 to 150,000 cubic feet capacity, upon ground which was acquired some years ago for the purpose, and to lay a new 12-inch main from the works so as to give a sufficient supply. A Committee is considering the matter.

Pitlochry must not be forgot at this period of reckoning up results. It, too, has had a year of progress in its gas supply; the output having been more than 4,750,000 cubic feet, which was 400,000 cubic feet above 1894. That is a large increase for a works of the size; but it is almost too large, as it is on account of the increased demand for gas that it is proposed that the Gas Company should embark in an electric lighting venture.

An electric light installation which has been constructed by the Corporation of Ayr, to plans by Mr. Robert Hammond, of London, is all but completed; and the formal opening ceremony in connection with it is to be presided over by Lord Kelvin on Wednesday next. The original cost contemplated was £15,000; but this amount has been very largely exceeded. The public lighting provision consists of 25 lamps.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 4.

Sulphate of Ammonia.—Throughout the week, the market has been quiet, but steady. There has been a fair amount of inquiry; but buyers' ideas are rather below recent current values, and only a moderate amount of business has resulted. Makers, having sold pretty freely late in December, do not seem in any hurry to press their further production on the market, but are inclined rather to wait in hope of larger orders coming forward with the New Year. The quotations are £8 10s. to £8 12s. 6d. f.o.b. at the ports. In the forward position, business is reported at £8 12s. 6d. f.o.b. Leith, February delivery; while £8 15s. to £8 17s. 6d. is being quoted for delivery over the later spring months.

Nitrate of Soda is steady at 7s. 7½d. per cwt. for ordinary quality, and 7s. 9d. for refined, on spot. Due cargoes, ordinary quality, are worth 7s. 6¾d. to 7s. 7½d. per cwt., according to size.

LONDON, *Jan.* 4.

Tar Products.—No new business of any magnitude has been reported during the past week. Benzol buyers are leaving the markets severely alone; but, as most makers of benzol are very fully committed, the market continues steady, although values are quotably lower. Pitch lacks firmness; but this is rather due to the efforts of dealers to force down prices. Most producers being fully sold, the effort is probably a market operation only, as no business is resulting. Carbolic acid keeps in good request; and ½d. more is being asked for 60's—crystals being very firm, and reported scarce.

Market values during the week have been as follows, less the usual discount: Tar, 18s. to 24s. Pitch, nominal, 33s., west coast; 36s., east coast. Benzols, nominal, 90's, 2s. 3d.; 50's, 2s. Solvent naphtha, 1s. 4d. for shipment; 1s. 6d. for home consumption. Toluol, 1s. 10d. Crude, 30 per cent. naphtha, 10d. Creosote, 1¼d. Naphthalene, pressed, 45s.; drained, 27s. 6d. Cresylic acid, 1s.; crude, 10d. Carbolic acid, 60's, 1s. 9½d.; 75's, 2s. 1d. Anthracene, "A," 11d. to 1s.; "B," 9d. to 10d.

Sulphate of Ammonia is in slightly better odour; and parcels are moving off a little more freely. Business during the week has remained fairly steady at the following prices: Beckton terms, £9; London, £8 12s. 6d.; Hull, £8 11s. 3d.; Tyne, £8 12s. 6d.; Leith, £8 10s.; Liverpool, £8 12s. 6d., less 3½ per cent. f.o.b. Gas liquor is quoted at 6s. to 7s. per ton for 10-oz. quality.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Business operations have necessarily been largely suspended during the past week, owing to the holidays; pits having in most cases been closed since Tuesday, and now only getting into work again. Just before the stoppages of the collieries, there was some increased activity in the demand for house coals; but this represents no real improvement in trade. Requirements for general manufacturing purposes continue much below the supplies coming upon the market; the only stronger feature being in engine classes of fuel, supplies of which have been restricted by the holiday stoppages of the pits in this and other districts. Prices with the commencement of the year remain practically unchanged. At the pit mouth, the average rates are 10s. to 10s. 6d. per ton for best Wigan Arley coals; 9s. to 9s. 6d., for seconds Arley and Pemberton four-feet; 7s. to 7s. 6d., for common house-fire qualities; 6s. to 6s. 6d., for steam and forge coals; 4s. 6d. to 5s., for best sorts of engine fuel; and 3s. to 3s. 6d., for common slack. Shipping prices also remain extremely low; 7s. to 7s. 6d. per ton being about the average figures obtainable for ordinary steam coal, delivered at the ports on the Mersey.

Northern Coal Trade.—Though the holidays interrupted the working at the collieries, there has still been a production in excess of the demand for some kinds of steam coal; and thus pits have been laid idle. A little better demand has set in the last day or two; but it will be some time before the steam-coal collieries are generally fully at work. Best Northumbrian steam coal is quoted 8s. per ton f.o.b., though some merchants speak of concessions from this price. Second-class steam coal is 7s. 6d. per ton, with only a moderate inquiry; and steam small coals are from 3s. 6d. to 3s. 9d. There is a fuller demand for manufacturing coals this week; but there is no alteration in prices' and much of the business is on contracts that will endure over several months. In the gas coal trade, there is now the greatest activity; and in some cases the contract deliveries are so large that there is no surplus for sale. Where there are any such quantities above those contracted for, the price that is generally asked varies from 6s. 6d. to 7s. per ton f.o.b. Household coal is also in steady demand; and the rates for shipment range from 10s. to 11s. per ton. There is no alteration this week in the prices of other kinds of coal. In coke, there are only moderate exports just now; but the inland demand is a little larger, as more furnaces have been put into blast in West Cumberland, and the Cleveland and Durham district takes up its full average quantity. The price is about 14s. 6d. per ton f.o.b. Gas coke is steady; and there are fair shipments to some of the near Continental ports. The home demand is good for household use; but for manufacturing purposes it has been lessened by the holidays. Deliveries under the new contracts are, however, again beginning. There are no alterations in price to be recorded.

Scotch Coal Trade.—This week there are no prices to quote; the usual Wednesday gathering of coal merchants in Glasgow having been interfered with by New Year Day. For the past year, however, it may be said that the average prices per ton f.o.b. Glasgow, as compared with the preceding year, were: Main, 1894, 6s. 6d.; 1895, 5s. 10d. Ell, 1894, 7s. 6d.; 1895, 6s. 9d. Splint, 1894, 7s. 6d.; 1895, 6s. 9d. Steam, 1894, 8s. 3d.; 1885, 7s. 6d. The trade at present is dull and languishing; stocks being so heavy that in some quarters it is feared that a further reduction in the miners' wages will be necessary. Shipments of coal amounted during the week to 145,332 tons—a decrease on the previous week of 1216 tons, but an increase over the corresponding week of last year of 16,873 tons. For the whole year, the shipments amounted to 7,479,940 tons—an increase as compared with the quantity in 1894 of 2,104,244 tons, which is accounted for by the low output last year during the Scotch miners' strike. As compared with 1893, when there was an increased output in Scotland in consequence of the miners' strike in England, there was a decrease of 448,054 tons; and as compared with 1892, when the trade was normal, there was a decrease last year of 209,972 tons.

Pontypridd Water Company.—A special meeting of the Directors of the Pontypridd Water Company was held last Tuesday, for the purpose of opening and accepting tenders for £20,000 new ordinary share capital, issued under the Company's Act of 1892. There was an extraordinary demand for the shares—the amount being doubly subscribed for. A large premium, running far on in four figures, was produced; and this, together with the premium realized at a former issue, has placed about £20,000 in the hands of the Company, free of interest, towards the cost of the reservoir which is now being constructed near the existing works above Maerdy. The new reservoir (which will have a capacity of 200 million gallons, and is five-eighths of a mile long and about a quarter of a mile wide) is expected to be completed in about eighteen months.

The Bolton Corporation and the Sale of Coke.—The question of the coke contracts is one which has occupied the attention of the Gas Committee of the Bolton Corporation for some considerable time; and at last week's meeting of the Town Council there was an interesting discussion on the subject. The Gas Committee's minutes contained a resolution to the effect that any person willing to contract for not less than 1000 tons of coke for any one year should have it delivered free of charge within the borough. Mr. Proctor moved an amendment to the effect that 100 should be substituted for 1000, on the ground that the small consumer was as much entitled to consideration as the large, and because by this means the Corporation would get rid of a much greater quantity of coke. The amendment was seconded by Mr. Uttley, and supported by a number of councillors. The Mayor (Alderman Dobson), who is the principal of an engineering firm in the town giving employment to several thousands of workers, asked how it was that his people could never get coke from the Bolton Corporation. He added that their coke was obtained from Bury; and he said it was extraordinary that a firm like his, using so much coke, could not get it from the Corporation. Alderman Miles, Chairman of the Gas Committee, replied to the discussion. He observed that they made 40,000 tons of coke in a year; and of this they sold 25,000 tons in Bolton at the best market price of the day. Therefore there were 15,000 tons left which had to be disposed of in some way or other. If any member could suggest a better method than the one at present adopted, the Committee would be happy to consider it. They tried to bring the coke within the reach of the millowners in the town, and to get them to use it in preference to either slack or burgy. In one instance, the reply was: "We could use the coke, provided the price was right." But he had to remind the Council that the price would be very much lower than the Corporation at present obtained for the extra quantity of coke outside the town. To do their duty by the Gas Department, they must get the best possible price for the residuals; and this was what the Gas Committee did. To agree to the suggestions made by those who supported the amendment would mean accepting at least 1s. lower per ton than was now obtained outside the town. The reason the firm with which the Mayor was connected could not buy coke in Bolton was because they had it from a neighbouring Corporation who adopted the same course as Bolton. To reduce the 1000 tons to 100 would mean a serious loss of revenue which his Committee were not prepared to recommend. On a division, the amendment was lost by 31 votes to 13; and the Committee's proceedings were confirmed.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 14).

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	22–23	−¼	4 11 4
100,000	10	„	7⅞	Do. 7 p. c.	16⅞–17½	..	4 5 8
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	105–107*	+⅛	4 13 5
200,000	10	16 Oct.	4	Belgrano (B. Ayres), Limited	7–8	..	5 0 0
100,000	Stck.	30 Dec.	5	Do. 5 p. c. Deb. Stk	90–95*	..	5 5 3
200,000	5	14 Nov.	6½	Bombay, Limited	6⅞–7¼	..	4 9 8
40,000	5	„	6½	Do. New, £4 paid	5–5⅛	..	4 14 7
380 000	Stck.	14 Aug.	12	Brentford Consolidated	270–275	+2	4 7 3
180,000	„	„	9	Do. New	210–215	..	4 3 9
50,000	„	„	5	Do. 5 p. c. Pref. Stock.	—	..	—
159,375	„	16 Dec.	4	Do. 4 p. c. Deb. Stock.	123–127	..	3 3 0
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	227–232	..	4 14 10
208,820	„	„	8	Do. A Ord. Stk.	183–188	..	4 5 1
933,500	Stck.	29 Aug.	5	Bristol	124–128	..	3 18 1
320,000	20	27 Sept.	11½	British	54½–55½	..	4 1 1
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	22½–23½	..	4 17 10
51,510	10	„	8⅛	Do. 7 p. c.	19–20	..	4 5 0
328,750	10	14 Nov.	4	Buenos Ayres (New) Limited	7⅞–8½	..	4 17 1
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100–102*	+1	5 17 8
150,000	20	11 July	8½	Cagliari, Limited	30–32	..	5 3 3
100,000	10	27 Sept.	6	Cape Town & District, Ltd.	12½–13	..	4 12 4
50,000	50	2 Nov.	6	Do. 6 p. c. 1st Mort.	56–58	..	5 3 6
550,000	Stck.	16 Oct.	13½	Commercial Old Stock	323–328	..	4 2 4
165,000	„	„	10½	Do. New do.	251–255	..	4 2 4
160,762	„	16 Dec.	4½	Do. 4½ p. c. Deb. do.	147–152	..	2 19 2
800,000	Stck.	16 Dec.	13	Continental Union, Limited.	268–273	..	4 15 3
200,000	„	„	10	Do. 7 p. c. Pref.	210–215	..	4 13 0
51,600	Stck.	29 Aug.	14	Croydon Com'cial A 10 p. c.	280–285	..	4 18 3
157,500	„	„	11	Do. B 7 p. c.	222–227	..	4 16 11
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	127–132	..	3 19 6
60,000	„	„	5	Do. 5 p. c. Pref.	—	..	—
486,090	10	26 July	11	European, Limited	25½–26½	..	4 3 0
354,060	10	„	11	Do. £7 10s. paid	17–18	..	4 14 3
5,646,590	Stck.	14 Aug.	12½	Gaslight & Coke, A, Ordinary	295–300	..	4 5 0
100,000	„	„	4	Do. B, 4 p. c. max.	107–112	..	3 11 5
665,000	„	„	10	Do. C, D, & E, 10 p. c. Pf.	287–292	..	3 8 6
30,000	„	„	5	Do. F, 5 p. c. Prf.	135–140	..	3 11 5
60,000	„	„	7½	Do. G, 7½ p. c. do.	200–205	..	3 13 2
1,300,000	„	„	7	Do. H, 7 p. c. max.	193–198	..	3 10 9
463,000	„	„	10	Do. J, 10 p. c. Prf.	287–292	..	3 8 6
476,000	„	„	6	Do. K, 6 p. c. Prf.	169–173	..	3 9 4
1,061,150	„	16 Dec.	4	Do. 4 p. c. Deb. Stk.	135–140	..	2 17 2
294,850	„	„	4½	Do. 4½ p. c. do.	145–150	..	3 0 0
908,000	„	„	6	Do. 6 p. c. do.	200–205	..	2 18 6
70,000	10	30 Oct.	6	Hongkong & China, Limited	13½–14½	..	4 2 9
3,800,000	Stck.	14 Nov.	12	Imperial Continental	232–236	..	5 1 8
376,400	100	1 Aug.	4	Do. 4 p. c. Debs. Red.	100–103	..	3 17 8
473,600	Stck.	14 Aug.	3½	Do. 3½ p. c. Deb. Stk „	107–109	..	3 4 2

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
75,000	5	16 Dec.	6	Malta & Mediterranean, Ltd.	6–6½	..	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	113–116	..	4 6 2
250,000	100	„	4½	Do. 4½ p. c. Debs.	107–109	..	4 2 7
541,920	20	14 Nov.	5	Monte Video, Limited	16½–17½	..	5 14 3
150,000	5	28 Nov.	8	Oriental, Limited	7⅞–8½	..	4 16 11
135,000	5	„	8	Do. New, £4 10s. paid	6½–6⅞	..	5 6 8
15,000	5	„	8	Do. do. 1879, £1 paid	1¼–1½	..	4 11 5
60,000	5	12 Sept.	7	Ottoman, Limited	5–5⅛	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	1⅛–1⅜	..	11 8 6
420,000	100	2 Nov.	6	People's Gas } 1st Mtg. Bds.	105–110	..	5 9 1
500,000	100	9 Dec.	6	of Chicago } 2nd Do.	100–105	..	5 14 3
150,000	10	16 Oct.	7	San Paulo, Limited	11–12	..	5 16 8
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	377–382	..	4 1 2
1,350,000	„	„	12	Do. B do.	308–313	..	3 16 8
308,685	„	„	13	Do. C do.	325–330	..	3 18 9
800,000	„	11 July	5	Do. 5 p. c. Deb. Stk.	175–178	..	2 16 2
60,000	Stck.	12 Sept.	11½	Tottenham & Edmonton, A	250–255	..	4 10 2
60,000	„	„	8½	Do. B	—	..	—
170,380	10	30 Dec.	10	Tuscan, Limited	13–14*	..	7 2 10
149,900	10	2 Jan.	5	Do. 5 p. c. Debs. Red.	100–102*	..	4 18 0

WATER COMPANIES.

746,021	Stck.	30 Dec.	10½	Chelsea, Ordinary	292–297*	..	3 9 0
150,000	„	„	5	Do. 5 p. c. Pref.	165–170*	..	2 18 10
160,000	„	„	4½	Do. 4½ p. c. Pref. Stk., 1875	—	..	—
175,785	„	27 Sept.	4½	Do. 4½ p. c. Deb. Stock	153–158	..	2 17 0
1,719,514	Stck.	16 Oct.	7	East London, Ordinary	215–220	..	3 3 7
654,740	„	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	155–158*	..	2 17 0
100,000	„	„	3	Do. 3 p. c. Deb. Stk.	104–106*	..	2 16 7
700,000	50	16 Dec.	6½	Grand Junction	114–118	+1½	2 15 0
280,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	140–145	..	2 15 2
708,000	Stck.	29 Aug.	12	Kent	310–315	..	3 16 2
160,003	„	„	7	Do. New, 7 p. c. max.	200–205	..	3 8 3
1,043,800	100	30 Dec.	7½	Lambeth, 10 p. c. max.	245–250*	+1½	2 18 3
406,200	100	„	7½	Do. 7½ p. c. max.	207–212*	+½	3 8 5
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	143–148	..	2 14 2
500,000	100	14 Aug.	12⅝	New River, New Shares	385–390	+2½	3 3 7
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	143–148	..	2 14 2
902,300	Stck.	16 Dec.	6	S'thwk & V'xhall, 10 p. c. max.	150–155	..	3 17 5
126,500	100	„	6	Do. Do. 7½ p. c. do.	139–142	..	4 4 6
489,200	Stck.	„	5	Do. Do. 5 p. c. Pref.	165–170	..	2 18 10
1,019,585	„	—	4	Do. 4 p. c. A Deb. Stk.	144–147	..	2 14 6
1,155,066	Stck.	16 Dec.	10	West Middlesex	288–293	..	3 8 3
200,000	„	„	4½	Do. 4½ p. c. Deb. Stk.	155–160	..	2 16 3

*Ex div.

The Finances of the Dublin Corporation.—Further interest has been aroused in the finances of the Dublin Corporation by the recent issue of the report of the Local Government Auditor (Mr. J. W. Drury) on the accounts for the year 1894; the particularly unpleasant feature of it being certain surcharges amounting to about £300, a large proportion of which was spent in connection with the abortive Improvement Bill. The members of the Corporation who are held liable for this expenditure number about forty; and they are those who voted in favour of the resolution of Nov. 9, 1894, authorizing the promotion of the Bill. One of the items is £30, the cost of a deputation to London in this connection.

Suicide by Gas.—Evidence of the pessimistic tendency of the age, and of the spread of the mania for self-destruction, has been furnished by the formation in New York of the Suicide Club, which, according to a London evening paper, recently gave a gruesome proof of its existence. It appears that a few days ago a young man, named Thomas Milford, arrived at the Palace Hotel, Newark, which is about nine miles from New York, and, in the course of his conversation with the clerk, stated that at a meeting of his club he had been selected to kill himself on the 27th ult. The clerk treated the matter as a joke; but early on the morning of that day, the hotel watchman became aware of a strong odour of gas issuing from Milford's room. On opening the door, the strange visitor was found senseless and dying from the effects of the gas, which he had turned on. In his coat pocket were found papers showing that he was indeed a member of the New York Suicide Club, and had drawn the fatal lot—his death warrant—at its last meeting. The paper was headed by the club insignia of skull and cross-bones printed in red, with "December 27th" below. This is the eighth suicide committed by members of this extraordinary society.

The Torquay Water Committee and the Engineer.—The question of filling the vacancy caused by the death of Mr. T. S. Weeks, the Water Engineer to the Torquay Corporation, was under the consideration of the Water Committee last week. A proposal to divide the duties was suggested and discussed. It was thought that, so far as Torquay and its neighbourhood were concerned, the duty of controlling the water supply should be entrusted to the Borough Surveyor; and that the supervision of the reservoirs at Tottiford should be committed to a foreman resident on the works. A saving would, it was contended, result from this arrangement; but the Committee rejected it, perhaps because it did not offer any adequate provision for the control of the supply to the out-districts, including Cockington, St. Mary Church, and Newton Abbot, which are supplied from Torquay. It was decided to advertise for a Water Engineer; but there was a difference of opinion as to the commencing salary that should be offered. Mr. Weeks received £250 per annum; and the Committee were equally divided as to whether £150 or £200 should be offered, with annual increases. A majority of the Committee decided to pay to Mrs. Weeks, the widow of the late Engineer, the sum of 200 guineas, as a gratuity for extra work performed by him in 1893 and 1894 in connection with the projected purchase of the watershed and promotion of the Water Bill.

The Waters of the Little Don.—A special meeting of the Doncaster Town Council was held a short time since for the purpose of authorizing the Water Committee to take steps in support of the Water Bill which is being promoted by the Sheffield Corporation. The Mayor (Mr Brightmore) presided, and moved a formal resolution, which was carried unanimously. Subsequently a public meeting of burgesses was held for the purpose of approving of the resolution. The Mayor said it was proposed to give the Corporation full power to protect the interests of the burgesses in the only remaining unappropriated watershed on the River Don which was available for water supply for domestic purposes. The Barnsley Corporation were seeking to appropriate from the Little Don valley a considerable part of the watershed, although they had not anything like utilized the resources of the watershed in which their present works were situated. With the prospect of a great increase in the population of Doncaster, the Corporation, after negotiations with Sheffield and Rotherham, had agreed upon a scheme by which Sheffield undertook to promote a Bill for the appropriation of the waters of the Little Don, and afford a supply to Rotherham and Doncaster. A resolution approving of the action of the Council was passed. At a public meeting of owners and ratepayers of Sheffield last Friday week, a resolution was passed consenting to the promotion of the Bill by the Corporation in the coming session of Parliament.

Dangerous Paraffin Lamps.—The "Lancet" publishes a long report of the Commission appointed by that journal to inquire into the subject of dangerous lamps. The "Lancet" appeals for legislation, and states that the essential points of construction in a paraffin lamp are, according to the observations made in the investigations, as follows: (1) The reservoir should be of metal or non-fragile material. It should be fixed firmly in the base, and not rest loosely, as is the case with many beautiful and artistic lamps, in a cup-shaped stand. (2) The lamp should have a base heavy enough to minimize the risk of upsetting. (3) The burner should be connected to the reservoir by a screw with well-cut thread, requiring at least three entire turns before it becomes detached from the reservoir. It should be made tight to the reservoir by means of a washer. Bayonet joints or pin-and-slot joints, not to say the mere fitting on of the burner like a cap on the mouth of a reservoir, should be prohibited. (4) The wicks should be constructed of material of good quality, and should fill the space of the wick-tube. The wick should be replaced by a new one as it becomes worn and diminishes in size. Circular wick-tubes should never be fed by a flat wick, the edges of which are not likely to close up in the wick-tube. The wick in these cases should be a complete cylinder. (5) The wick-tube should be made to descend into the reservoir within at least a quarter of an inch of the bottom. Assuming the screw of the burner to be free from defect, it would be impossible for oil then to escape—the scource of most of the danger of paraffin lamps, nearly all of which have their wicks hanging unguarded in the reservoir. This arrangement would also render it impossible for flame to travel into the reservoir space.

NEW "PENNY-IN-THE-SLOT" COOKERS.

Arranged specially for Prepayment Meters.

We have given particular attention to the strength and simplicity of these Cookers, which are constructed upon the principle of our celebrated "Eureka" Cooker, and are practically indestructible. They are very easily cleaned, and are all constructed in as many parts as possible, so that, in case of breakage, the parts may be readily and cheaply replaced.

No. 403 and 404.

No.	External Dimensions.			Oven.			Hot Plate.	No. of Boiling-Burners	Price.	White & namelled Crown extra.
	High.	Wide.	Deep.	High.	Wide.	Deep.				
401	18½	13½	11½	14	11	9½	13½ by 11½	1	28/6	—
402	24½	15½	15	18	11	11	15½ ,, 15	2	40/-	2/6
403	30	18	17	19	11	11	18 ,, 17	2	45/-	2/6
404	30	18	17	19	13½	11	18 ,, 17	2	50/-	2/6
404	If fitted with Enamelled-Lined and Jacketted Door and Fire-Brick Crown, as adopted by The London Gaslight and Coke Co.								55/-	2/6

Any of these Cookers, except No. 401, can be fitted with Griller at an extra charge of 2/6; but the adoption of the Griller is not recommended for use with Prepayment Meters.

JOHN WRIGHT & CO., LIMITED,

The Oldest and Largest Gas-Stove Manufacturers in the World,

ESSEX WORKS, BIRMINGHAM, and 105, CHEAPSIDE, LONDON.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 65,095.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

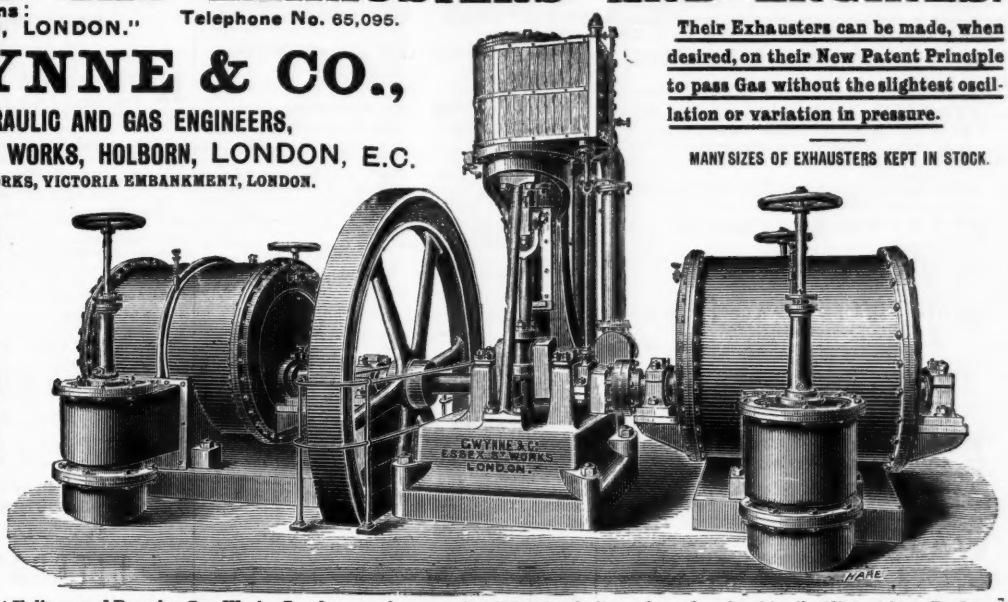
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.



Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

JOHN WM. O'NEILL, Managing Director, Palmerston Buildings, Old Broad Street, London, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 300 British Gas-Works

ANDREW STEPHENSON, 182, GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.

Telegrams: "Volcanism, London."

AMMONIACAL LIQUOR Wanted.

BROTHERTON AND Co., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.

BROTHERTON AND Co., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.

BROTHERTON AND Co., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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Offices: Commercial Buildings, LEEDS. Correspondence invited.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs. Before placing Orders, please write for Estimate.

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JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.

Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

W. C. HOLMES & CO., Huddersfield; AND 80, CANNON STREET, LONDON, Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also Improved Patent Rotary Scrubber-Washers.

*** See Advertisement p. II., centre of JOURNAL.

Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

SPECIAL PAINT FOR GAS-WORKS.

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NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO., VICTORIA PAINT WORKS, MANCHESTER.

For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
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WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.

Please write for Estimate before ordering elsewhere.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE. Information and Handbook on application. 70, CHANCERY LANE, LONDON, W.C.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.

Head Office: MIDDLESBROUGH, Correspondence invited.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. Sample and Price on application. OXIDE PAINTS, OILS, SULPHURIC ACID, &c. 120 and 121, NEWGATE STREET, LONDON, E.C. Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

CARBIDE OF CALCIUM and Exley's Patent Acetylene Gas Generator sold by READ HOLLIDAY AND SONS, Limited, HUDDERSFIELD.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and adroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "PORTER LINCOLN."

THE Undersigned is in a position to supply, at the very lowest Prices, the most suitable kind of BENZOL for enriching Gas, made from Hardman's Patent Carbonization Process, of which I am the Sole Patentee. On application, I would furnish Price on the most reasonable terms; giving advice how to utilize it on the most economical method.

J. HARDMAN, Manufacturing Chemist. Milton, Staffs.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.

Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.

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It is Worth Your While to Buy DIRECT.

THE RELIANCE LUBRICATING OIL COMPANY SUPPLY on APPROVAL "RELIANCE" NON-CORROSIVE LUBRICANTS (which, through their superiority, have the largest sale in the world)—viz., Engine, Cylinder, and Machinery Oils, 11½d.; Spindle Oil, 8½d.; Gas-Engine and Dynamo Oils, 1s. 6d. per gallon; Barrels Free and Carriage Paid. Also Liquids for Gas Making, Enriching, &c.

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BACK-PRESSURE IN PURIFIERS.

THE Valve invented by Mr. Cripps for Bye-Passing any Layer of Purifying Material (referred to by the President of the Incorporated Institution of Gas Engineers in his Inaugural Address) can be obtained of the Makers: C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP, and J. EVERY & SON, Phœnix Iron-Works, LEWES, to which Firms all inquiries should be addressed.

WANTED, by Advertiser with Seven years' experience in Gas-Works, a Situation to WORK SMALL GAS PLANT, or would go as ENGINE DRIVER and BOILERMAN in large Works. Excellent Reference.
Address H. J., 45, Mainstone Avenue, PLYMOUTH.

WANTED, a Gas-Fitter, Main and Service Layer.
For further Particulars, apply to JOHN M'COLL, Gas-Works, Halesowen, near BIRMINGHAM.

WANTED, for a Gas-Works in Wales, a good STOKER, to take charge of Shift. Must be a good Carbonizer, and used to Shovel and Exhauster. Wages, 28s. 6d. per week.
Applications, with Reference, &c., to be sent to F. CHUBB, Esq., Coal Contractor, SHREWSBURY.

GAS-STOVE TRADE.

TRAVELLER wanted with special experience and influence. Minimum guarantee to competent Man.
Apply fully, in strict confidence, to W. Z., Exchange, BIRMINGHAM.

WANTED, an experienced reliable Man as FOREMAN, with practical knowledge of Gas-Meter Making, to take charge of London Branch. Dwelling-House free. Good prospect for energetic Man.
Apply, stating Salary required, to WILLEY AND CO., Gas Engineers, EXETER.

THE Directors of the Plymouth and Stonehouse Gaslight and Coke Company require the services of an INSPECTOR.
Salary to commence at £170 per Annum. Age not exceeding 35 years.
Applicants must have a practical knowledge of Laying Gas-Mains and Service-Pipes, also the Testing and Fixing of Meters, taking Pressure, and the general routine connected with the Distribution Department.
Applications, stating recent experience, and accompanied by Testimonials (three only) as to ability and character, and endorsed "Inspector," to be sent to the undersigned not later than Monday, the 13th of January, 1896.

By order,
JOHN THOMAS,
Secretary.

Gas Offices: 1, Athenæum Terrace,
Plymouth, Dec. 27, 1895.

STATION METER.

WANTED, the loan of a Round Station METER (Second-hand), about 250-light.
State price per month to No. 2611, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A Sulphate of Ammonia SATURATOR, 6 ft. by 4 ft. by 4 ft., 20-lb. Lead, strong Wood Frame. Worked only one week. Made by Cairns and Laing, Glasgow. Cost £40.
Offers to No. 2610, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Gas Committee of the Burslem Corporation offer FOR SALE a STATION METER, capacity 25,000 cubic feet per hour—being replaced by a larger one. Inspection invited. No reasonable offer refused. Immediate removal necessary.
Apply to HENRY PEATY, Longport, STOKE-ON-TRENT.

FOR SALE—A Small Gasholder, 24 feet diameter, 11 feet high, with Four Columns, Back Balance Weights, and Inlet and Outlet Valves. In good condition, and present use.
Apply to JAMES Y. M'DONALD, Secretary, Gaslight Company, Galston, AYRSHIRE.

FOR SALE—All the Gas Plant at East Bridge Street, Falkirk, comprising—
HYDRAULIC MAIN, 50 ft. by 14 in. by 14 in. ∪ shape, in Six Sections.
Twenty ∩ MOUTHPIECES, 24 in. by 14 in., with Doors and Screws, 6-inch ASCENSION-PIPES and BRIDGE-PIPES.
One set of Annular CONDENSERS, 6-inch Connections.
Four PURIFIERS, 12 ft. by 8 ft. by 4 ft. 6 in., with Hydraulic Valves and Lifting-Crane. CORRUGATED IRON ROOF over Purifiers, with Six Cast-Iron Columns.
One STATION METER, by Milne, 4-inch Connections.
Three GASHOLDERS—One 40,000 Cubic Feet, in Cast-Iron Tank, with Six Columns and Counterbalance Weights; one 14,000 Cubic Feet, with Four Columns; and one Telescope Holder, 9000 Cubic Feet. Four Columns and Counterbalance Weights.
The Plant may be inspected on application to he Manager, P. B. Watson.
Offers will be received for the whole or any part of the Plant, as offerers see fit.
The Commissioners do not bind themselves to accept the highest or any offer.
Offers to be lodged with

JAMES WILSON,
Town Clerk.

Burgh Buildings, Falkirk,
Dec. 13, 1895.

GAS-ENGINE, for Sale—One-Horse Power, by Crossley Bros., equal to new. Removed for larger one.
Apply to W. CLARK, 21 and 22, Middle Avenue, The Market, OXFORD.

WIDNES CORPORATION GAS AND WATER WORKS.

GAS PLANT, &c., FOR SALE.

THE Gas and Water Committee have the following PLANT for disposal: ANNULAR CONDENSER, LIVESEY WASHER (each of a capacity of ¾ Million Cubic Feet per diem, and with 12-inch Connections), 12-inch STATION GOVERNOR, ENGINE and EXHAUSTER (capacity, 22,000 Cubic Feet per hour), MANN and WALKER TOWER SCRUBBER 38 ft. by 8 ft., and a WALKER PURIFYING-MACHINE of 1 Million Cubic Feet capacity per diem.
Further Particulars may be obtained on application to Mr. ISAAC CARR, Assoc.M.Inst.C.E., Gas-Works, WIDNES.

LITTLEHAMPTON GAS COMPANY, LIMITED.

THE Directors of the above Company invite TENDERS for the surplus TAR and LIQUOR produced at their Works, for the Twelve Months commencing Jan. 1, 1896.
The tenders to state the price per ton for the Tar, and also the price per ton for the Liquor, tested by Twaddel's No. 1 Hydrometer.
All further Information to be obtained of the Company's Engineer and Manager, Mr. A. W. Elton; and tenders must be sent to the undersigned on or before the 15th of January next.

By order,
UPPERTON SEAR,
Secretary.

THE Gas Committee of the Leeds Corporation invite OFFERS, at a price per ton, for two double-lift GASHOLDERS, with Cast-Iron Columns, &c., now in use at the Meadow Lane Gas-Works.
The Holders can be seen, and further Particulars obtained, on application to Mr. Tooley, the Manager of the above Works.
No offer will be considered except on the form provided by the Committee, which may be obtained on application to the undersigned.
Tenders, suitably endorsed, and addressed to the Chairman of the Gas Committee, Municipal Buildings, Calverley Street, will be received not later than Wednesday, the 15th inst.

R. H. TOWNSLEY,
General Superintendent,
Gas Department.

Leeds, Jan. 4, 1896.

THE Corporation of Middleton are prepared to receive TENDERS for the RETORTS, FIRE-BRICKS, and FIRE-CLAY required at the Gas-Works during the ensuing Year.
The Retorts to be delivered at the Middleton Railway Station, and the other Articles at the Gas-Works, Middleton, Free of Carriage.
Tenders, addressed to the Chairman of the Gas Committee, to be delivered at my Office on or before Wednesday, the 15th day of January, 1896, endorsed "Tender for Fire-Clay Goods."
Further Particulars may be obtained from Mr. Duxbury, Gas Manager.
The Corporation do not bind themselves to accept the lowest or any tender.

FREDERICK ENTWISTLE,
Town Clerk.

Town Hall, Middleton, near Manchester,
Dec. 30, 1895.

BURGH OF ROTHESAY.

THE Magistrate and Council of Rothesay invite TENDERS for the GAS PLANT, &c., required for their new Gas-Works, viz:—
1. RETORT-BENCH and CHIMNEY.
2. GASHOLDER TANK.
3. ROOFING of Retort-House and Coal-Store.
4. IRONWORK, MACHINERY, &c.
5. STEAM-BOILERS.
6. STATION METER.

Plans can be seen and Specifications, with Forms of Tender, obtained, from Andrew Gillespie, Consulting Engineer, 34, St. Enoch's Square, Glasgow.
Sealed tenders, endorsed "Tender for Gas-Works," to be delivered not later than Wednesday, the 22nd of January, to John T. Wilson, Town Clerk, Rothesay.
Town Clerk's Office, Rothesay,
Dec. 31, 1895.

THE URBAN DISTRICT COUNCIL OF ENFIELD.

TO WELL BORERS AND SINKERS.

THE Urban District Council of Enfield is prepared to receive TENDERS for the construction of Two 21-inch BORED WELLS and the DRIVING of a HEADING from an existing Well to cut the Bored Wells.
A Drawing of the work may be seen, and copies of the Specification obtained, at the Office of the Engineers, Messrs. John Taylor, Sons, and Santo Crimp, 27, Great George Street, Westminster, on payment of One Guinea, which will be returned upon receipt of a *bonâ-fide* tender.
Sealed tenders, endorsed "Tender for Bored Wells," to be sent in to me not later than Noon, on Wednesday, the 15th day of January, 1896.
The Council does not bind itself to accept the lowest or any tender.

By order of the Council,
T. W. SCOTT,
Clerk.

Court House, Enfield,
Dec. 27, 1895.

TO INVESTORS AND OTHERS.

COLCHESTER.
IMPORTANT SALE OF GAS SHARES.

EDWD. SMITH AND BOGGIS
AND
SEXTON AND GRIMWADE
(Who are jointly concerned)

HAVE received Instructions from the Directors of the Colchester Gas Company to SELL BY AUCTION, at the Three Cups Hotel, Colchester, on Wednesday, Jan. 15, 1896, at Six o'clock in the Evening precisely, in lots to suit small as well as large Investors, an issue of

200 SHARES OF £20 EACH IN THE COLCHESTER GAS COMPANY.

These Shares will rank equally with the present Shares of the Company, upon which a Dividend of Seven per Cent. has been paid for many years past.
Particulars and Conditions of Sale may be obtained of the Solicitor to the Company, HENRY GOODY, Esq., COLCHESTER; or at the AUCTIONEERS' Offices, COLCHESTER, HADLEIGH, and IPSWICH.

In Paper Cover, Price 1s.

GASHOLDERS
WITH OR WITHOUT
GUIDE-FRAMING.

A Discussion between E. LLOYD PEASE and F. SOUTHWELL CRIPPS.

To which is added a Synopsis of

LITERATURE ON GASHOLDER CONSTRUCTION,

Containing references to all the Literature (English and Foreign) on Reducing or Abolishing the Guide-Framing of Gasholders, also the principal Literature on Gasholder Construction generally, compiled to March, 1893; with a List of all the English and Foreign Periodicals connected with the Gas Industry.

COMPILED BY

F. SOUTHWELL CRIPPS,

Associate Member of the Institution of Civil Engineers; Fellow of the Imperial Institute; Member of the Institution of Gas Engineers; Member of the Society of Arts

AUTHOR OF

"The Guide-Framing of Gasholders and Strains in Structures Connected with Gas-Works;"
"The Flow of Gases and Proportioning Gas-Mains," &c.

LONDON:
WALTER KING, 11, Bolt Court, Fleet Street, E.C.

"BEAR CREEK" CANNEL.

LOG MOUNTAIN COAL, COKE, AND TIMBER CO.
PINEVILLE, KENTUCKY, U.S.A.
Cable Address: "Hull, Pineville."

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W. J. WILSON & CO., Suffolk House, Cannon St., E.C.

LOW MOOR BLACK BED
GAS COAL.

YIELD OF GAS PER TON - 10,375 CUBIC FEET.
ILLUMINATING POWER - 17·50 SPERM CANDLES.
COKE - - - - - - - - - 75 PER CENT.

Prices, f.o.r. or f.o.b., on application to
GEORGE & JOHN HAIGH,
RAVENS LODGE AND CONYERS' COLLIERIES,
DEWSBURY.

A TRIAL IS RESPECTFULLY SOLICITED.

ARMSTRONG'S PATENT
CANDLE SAFETY LAMPS.

No. 1. No. 2. No. 3.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

GAS PURIFICATION.

Best Absorbent of Sulphuretted Hydrogen, &c.

JAMES E. CAMPBELL,
Patentee and Manufacturer,
96, MILL STREET, BRADFORD, MANCHESTER.

PRICES, &C., ON APPLICATION.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.
For Particulars, Price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS:—

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, $16\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) $13\frac{3}{4}$ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . $13\frac{1}{2}$ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor $94\frac{1}{2}$ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal*; and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

NOTICE.

Whereas it has come to the knowledge of the INCANDESCENT GAS LIGHT COMPANY, Limited, of Palmer Street, Westminster, that a Company called the "Meteor" Incandescent Lighting Company, Limited, is selling and offering for sale a form of Incandescent Gas Light known as the "Meteor" Incandescent Gas Light.

This is to Give Notice that the Incandescent Gas Light Company, Limited, will commence actions for infringement of their Patents against all persons found dealing in any manner with the said "Meteor" Incandescent Gas Light which is constructed in infringement of the Patents of the Incandescent Gas Light Company, Limited. The validity of these Patents has been established, and a certificate to that effect has been granted, by the Hon. Mr. Justice Romer.

FAITHFULL & OWEN,
11, Victoria Street, S.W.
Solicitors to the Incandescent Gas Light Company.

NOTICE.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, Hereby Give Notice, that a Firm of F. J. Putz & Co., 16 and 17, Great St. Helen's, London, are advertising for sale Incandescent Gas-Light Apparatus called the "Champion" Incandescent Gas-Burner, and are stating in their circular that such Apparatus may be legally sold throughout the United Kingdom without Infringement of any existing Patent.

This is to Give Notice to the Public and the Trade that Actions for Infringement of Patent and for an Injunction will be immediately commenced by the Incandescent Gas-Light Company, Limited, against any persons using or selling such Apparatus.

The validity of the Company's Patents has already been certified by Mr. Justice Romer; and Solicitor and Client costs will be enforced in all cases.

FAITHFULL & OWEN,
11, Victoria Street, S.W.
Solicitors for the Incandescent Gas-Light Company, Limited.

NOTICE.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, Hereby Give Notice, that they only supply their Mantles subject to the following express Conditions, which are printed and pasted on each box:—

"The Incandescent Gas-Light Company, Limited, in supplying the Mantle contained in this box, grant a Limited License to the purchaser to sell or use the same on the express condition that neither the purchaser nor any other person into whose hands the same may come shall use or sell the said Mantle except in connection, or for use, with Burners sold or supplied by the Company; any other sale or use will amount to Infringement of the Company's Patents. The Company supply Mantles for the purpose of renewals at the nominal price of 1s. 3d., subject to the Conditions and Limitations above set forth."

In the case of *The Incandescent Gas-Light Company, Limited v. Cantelo*, Mr. Justice Wills upheld the Validity of these Conditions and Limited License; and, in the course of his Judgment, said:—

The patentee has the sole right of using and selling the articles; and he may prevent anybody from dealing with them at all. Inasmuch as he has the right to prevent people from using them or dealing in them at all, he has the right to do the lesser thing—that is to say, to impose his own conditions. It does not matter how unreasonable or how absurd the conditions are. It does not matter what they are if he says at the time when the purchaser proposes to buy, or the person proposes to take a license: 'Mind I only give you this license on this condition;' and the purchaser is free to leave it or take it as he likes. If he takes it, he must be bound by the condition."

In the case of *The Incandescent Gas-Light Company v. Hirschfeld and Others*, the Honourable Mr. Justice Romer certified that the Validity of the Plaintiffs' Patents was established. Infringers in future will be liable to costs as between Solicitor and Client.

(Signed) FAITHFULL & OWEN,
Solicitors for the Incandescent Gas-Light Company, Limited.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
8 Lombard Street, NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

TO ENGINEERS & MANAGERS.

ESTABLISHED OVER 50 YEARS.

This is to certify that I, SAMUEL NELSON, am the only ORIGINAL MAKER of the SOLID LEAD SATURATOR, or the CASED SATURATOR.

All Estimates given free for Lead Chemical Burning, and also Contracts for Sulphate Saturators.

Note Address—
20, SPRING GARDENS, BOLTON, Lancashire.
Please write for Estimate before ordering elsewhere.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

Following the acquisition of new Works situated in the heart of the cheapest Coal, Iron, and Steel Districts, we have added to our Technical Staff the

MOST SUCCESSFUL MODERN EXPERTS

in the designing of

AUTOMATIC COAL & COKE HANDLING PLANTS

WE EARNESTLY WISH ENGINEERS TO INSPECT OUR LATEST DESIGNS.

New CONVEYOR Co., Ld.,
3 & 4, Lime Street Square, London, E.C.

TROTTER, HAINES, & CORBETT,

Bvattell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

Shipments Promptly and Carefully Executed.

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OXIDE OF IRON.

James Hunter, Miner, and Shipper of

NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

5, PRINCES STREET, PORT GLASGOW.

Telegrams: "Hunter, Port Glasgow."

Established 1872.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

Analysis—		
Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON, Fitter.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

Coal Owners, Newcastle-on-Tyne;

OR

E. FOSTER & CO.,

21, John Street, Adelphi, London, W.C.

TAR AND LIQUOR PURCHASED.

JOHN CLARKSON MAJOR,

(Established 1851.)

Tar Distiller and Manufacturing Chemist,

WOLVERHAMPTON.

THOMAS TURTON AND SONS, Limited,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

London Office:

90, CANNON STREET, E.C.

KENT'S THICK GAS COAL

RAISED AT

The Wharncliffe Woodmoor Colliery,

BARNSLEY.

Yield of Gas, nearly 12,000 *Cubic Feet per ton of Coal; and Illuminating Power nearly* 17½ *Candles.*

The following is a complete ANALYSIS made by Mr. R. O. PATERSON, C.E., Gas-Works, Cheltenham:—

Specific Gravity (Water 1)	1·276
Weight of One Cubic Foot	79·700 lbs.

PROXIMATE ANALYSIS.

Moisture in Coal	2·68 per cent.
Volatile Matter	35·60 ,,
Fixed Carbon	58·80 ,,
Sulphur	0·96 ,,
Ash	1·96 ,,

COMMERCIAL ANALYSIS.

Gas per Ton of Coal	11,760 cub. feet.
Gas per Cubic Foot of Coal	418 ,,
Illuminating Power	17·44 candles.
Value of One Cubic Foot in Sperm	418 grains.
Value per Ton of Coal in Sperm	703 lbs.
Coke per Ton of Coal	1367 ,,
Coke	61·05 per cent.
Ash in Coke	3·21 ,,
Sulphur Eliminated with Volatile Products per Ton of Coal	9·4 lbs.
Sulphur in Coke per Ton of Coal	12 ,,
Ammoniacal Liquor per Ton of Coal	19·7 galls.
Tar per Ton of Coal	12·2 ,,

R. O. PATERSON, C.E.

Gas-Works, Cheltenham, 8th August, 1894.

For Price, &c., apply to the

Wharncliffe Woodmoor Colliery Co

LIMITED,

BARNSLEY;

Or to **Mr. W. H. HARVEY,**

17, Old Queen Street, Westminster, S.W.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

THE DRUM
FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.
See Advertisement in last and next issue.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

HARPER & MOORES,
STOURBRIDGE.
MANUFACTURERS OF
BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1826.

BOWENS' Ltd. Successors,
STOURBRIDGE.
MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
Established 1860.

W. E. SANDER,
COMMISSION AGENT, BERLIN, 41, FRIEDRICH STR.
SPECIALITIES: Incandescent Lamp Burners and Mantles (with or without electric lighting from any distance, by button from the wall, etc.).
INCANDESCENT SPIRIT LAMPS.
Electro-technical Ware of all kinds.
IMPORT and EXPORT.

WILSON CARTER & PEARSON,
GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.
ADDRESS CHIEF OFFICES:
Temple Buildings, 50, New Street, Birmingham.

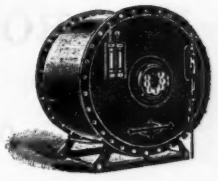
OXIDE OF IRON.
NATURAL BOG ORE FROM OWN MINES.
Samples and Prices on application.
WM. H. MÜLLER & CO.,
81, PALMERSTON BUILDINGS, LONDON, E.C.
TRADE MARK: "Compascum." Telegraphic Address: "FERRUM."

OSLER,
BIRMINGHAM.
MANUFACTURERS
OF GASELIERS
IN GLASS AND METAL.

JOSEPH CLIFF & SONS,
INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.
LONDON OFFICES & DEPÔTS:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
Queen Street.
MACHINE-MADE RETORTS
Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.
RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

The Climax of Regenerative Gas Lighting!!

THE
"VERTMARCHE"
A 280-CANDLE POWER
PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England.
HENRY GREENE & SONS,
153 & 155, CANNON STREET,
LONDON BRIDGE, E.C.
PARTICULARS AND PRICES FREE. AGENTS WANTED.

JAMES MILNE & SON, LTD.,
GAS ENGINEERS,
MILTON HOUSE WORKS, EDINBURGH.
LONDON. — GLASGOW. — LEEDS.


"LOFTUS"

PATENT STREET-LANTERNS

100
PER CENT.
MORE LIGHT
CAN BE OBTAINED FROM ANY FLAME BY USING THIS LANTERN INSTEAD OF THOSE NOW USED.

No. 420 G.

PUBLIC BODIES, CORPORATIONS, AND GAS COMPANIES CAN SAVE 50 PER CENT. BY USING THIS LANTERN FOR STREET LIGHTING.

Can be fitted for **OIL** where required.

FIRST COST LITTLE MORE THAN ORDINARY LANTERNS.

Exceedingly Brilliant Light in direction of Lenses, Lights Footway all along between Lamps.

For Further Particulars, inquire for PRICE LIST "L" from

THE SUNLIGHT & SAFETY LAMP CO., LTD.

ROSCAR WORKS, BIRMINGHAM.

Telegraphic Address: "PROGRESS, BIRMINGHAM." A.B.C. Code used.

Or from London Agent: J. JONAS, 38, Lime Street, E.C., where a Specimen Lamp can be seen.

WILLEY & CO.,

GAS ENGINEERING CONTRACTORS,

EXETER,

For **GASHOLDERS** and all kinds of **ENGINEERING APPARATUS.**

For **WET** and **DRY GAS CONSUMERS' METERS.**

For **COIN METERS,** their Patent Automatic is admitted to be one of the best and most reliable in the Market. Largely used in the Metropolis.

For **GAS-FITTINGS,** Registered Designs in Extensive Variety.

Manufacturers of the **LIVESEY WASHER.**

Agents for the **MAXIM CARBURETTOR.**

New Works, 5 acres in extent, recently opened in the City of Exeter for the Manufacture of every kind of Apparatus used in the Production, Distribution, and Sale of Gas.

Telephone 132. **Telegraphic Address: "Willey, Exeter."**

ESTABLISHED 30 YEARS.

IMPROVEMENTS IN STREET LIGHTING.
HIGHEST EFFICIENCY WITH GREATEST ECONOMY.

LIGHTING AUTHORITIES, GAS ENGINEERS, & GAS MANAGERS

Are invited to inspect the

INCANDESCENT GAS-LIGHT

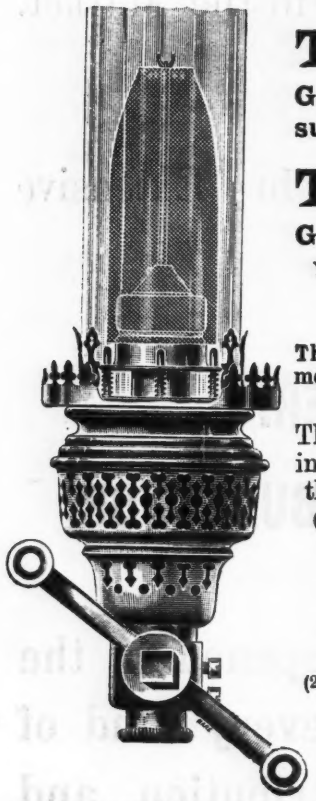
Which has now been successfully adapted to the purposes of

STREET LIGHTING,

THE DIFFICULTIES CAUSED BY VIBRATION HAVING BEEN OVERCOME BY THE USE OF A SPECIAL BURNER, WHICH GIVES HIGHLY SATISFACTORY RESULTS.

This System of Lighting meets the Requirements of all the Lighting Authorities in those Districts where it is desired to effect an Improvement in Street Lighting, without any increase of expenditure.

Two forms of Burners are specially recommended for Street Lighting:—

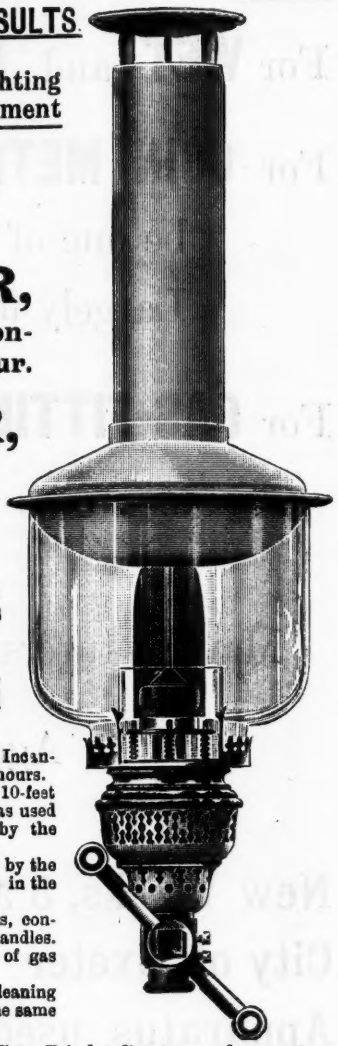


The "C" BURNER,

Giving a Light of 60 Candles, with a Consumption of 3½ Cubic Feet of Gas an Hour.

The "S" BURNER,

Giving a Light of 25 to 30 Candles, with a Consumption of 2¼ Feet of Gas an Hour.



The INCANDESCENT GAS-LIGHT has been tried with most satisfactory results for Street Lighting purposes in many Towns throughout the United Kingdom.

The Lighting Engineer of the Kensington Vestry, in a report dated the 14th of May, 1895, addressed the Works and Sanitary Committee as follows:—

(1) During the months of January, February, and March, 1895, 31 Incandescent Gas-Lamps were in use for an average period of 1167·89 hours. The estimated quantity of gas that would have been consumed by the 10-feet flat-flame burner was 11,678 cubic feet. The actual quantity of gas used by the Incandescent Gas-Light Company's Burners, as recorded by the meters, was 4415 cubic feet.

After allowing for the extra cost of up-keep, the gain to the Vestry by the use of these burners was £20 3s. 4½d., and a large increase in the Illumination of the Street.

(2) The illuminating power given by the Incandescent Gas-Burners, consuming 3·78 cubic feet of gas per hour, was found to be equal to 60 candles. That given by the flat-flame burners, consuming 10 cubic feet of gas per hour, was 26 candles.

The lanterns fitted with Incandescent Burners only require cleaning 9 times in 90 days, as compared with 26 times' cleaning in the same period required by the lanterns fitted with flat-flame burners.

The net result therefore appears to be that, by the use of the Incandescent Gas-Light System, the saving effected is 15s. per lamp for this quarter, after paying for the up-keep of the Burner, and at the same time more than double the light is obtained. It must be noted, however, that these results were obtained with the ordinary burners, and not with the improved burners with the anti-vibration springs. With the latter, the expense of up-keep would be materially reduced, and the saving consequently increased.

For further Particulars, apply to

THE INCANDESCENT GAS-LIGHT COMPANY, LTD.,

PALMER STREET, WESTMINSTER, LONDON, S.W.

ARROL-FOULIS

PATENT AUTOMATIC MACHINERY

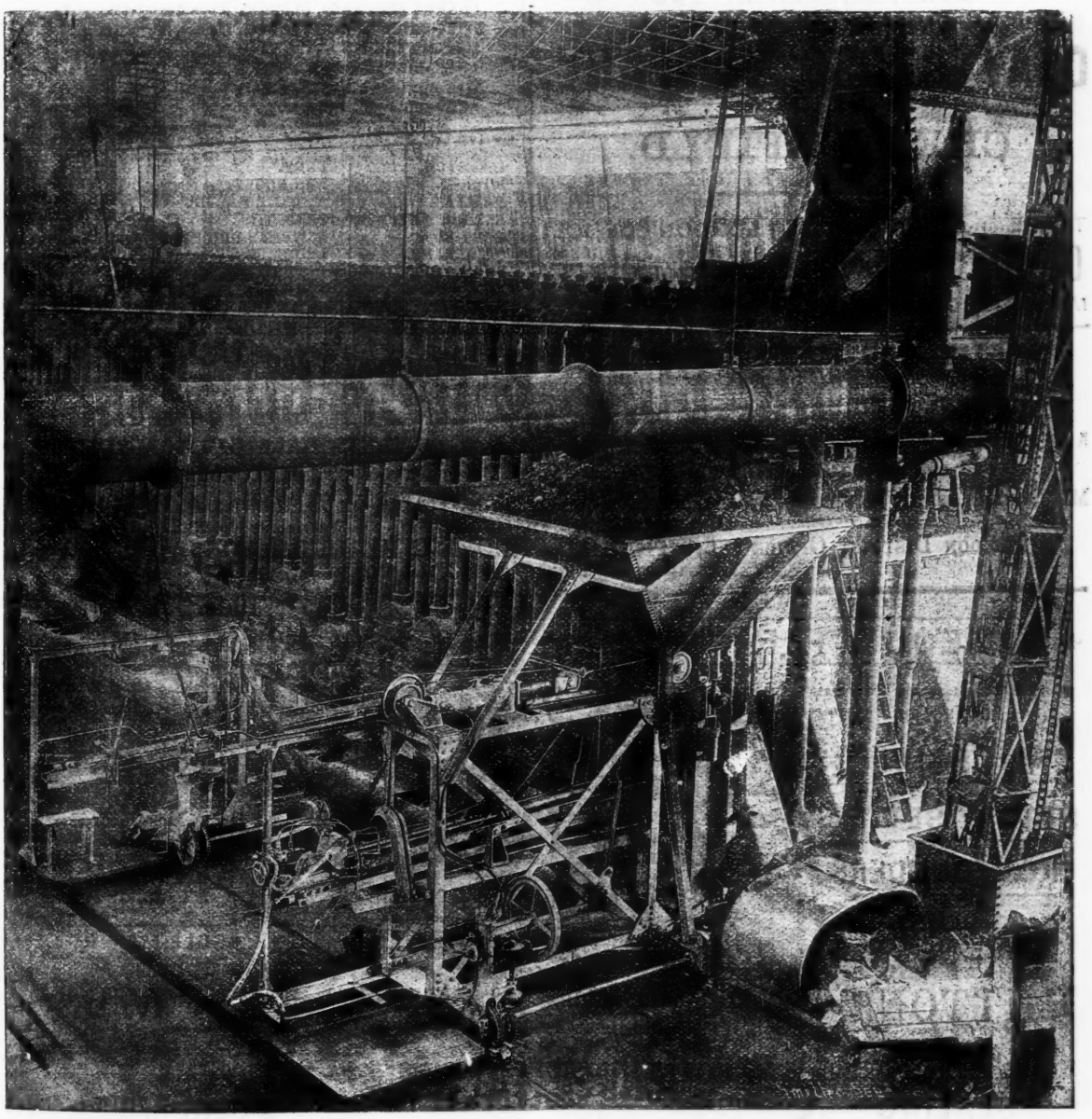
FOR

CHARGING AND DRAWING GAS-RETORTS

SIR WILLIAM ARROL & CO., Ltd., Sole Makers,

GLASGOW.

Plans and Estimates furnished on application.



The above engraving shows the interior of a Retort-House at the Tradeston Gas-Works, Glasgow, where the Machines have been at work since the beginning of 1893, drawing and charging **960 Retorts every 24 hours. 79 Drawing-Machines and 52 Charging-Machines are at work, or in course of construction.**

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT

MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,

CHESTERFIELD.

TRADE MARK.	TELEGRAMS:	LONDON OFFICE:
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	CLAY CROSS.	

GODDARD, MASSEY, & WARNER'S

IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES, APPLY TO

GODDARD, MASSEY, & WARNER,

ENGINEERS,

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The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.
TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.
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TELEGRAPHIC ADDRESS: "PARKER LONDON."

GASEOUS FIRING A SPECIALTY.

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GAS ENGINEERS.
RETORT SETTERS.
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SOLE MAKERS OF

"MITTON'S" PATENT SELF-SEALING RETORT-LID.

JOMS DRAKE & SON

SOLE AGENTS For "HISLOP'S" PATENT REGENERATIVE FURNACES. FOR ENGLAND, WALES & ABROAD.

OVENDEN, HALIFAX.

Telephone No. 43. HALIFAX EXCHANGE.

CONTRACTORS.
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&c. &c.

SOLE MAKERS OF

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LONDON OFFICE;
60, QUEEN VICTORIA ST., E.C.

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MESSRS. HUMPHREYS & GLASGOW

Have constructed their EUROPEAN type of

CARBURETTED WATER-GAS PLANT

At the following Gas-Works:—

Copenhagen	700,000 Cub. Ft.	Brussels	700,000 Cub. Ft.
Belfast	1,700,000 ,,	Liverpool	2,500,000 ,,
Glasgow	300,000 ,,	Tottenham	600,000 ,,
Santiago	400,000 ,,	Brighton	1,250,000 ,,
Swansea	700,000 ,,	Bath	1,000,000 ,,

And have now under Contract:—

Belfast (Second Contract)	3,500,000 Cub. Ft.	Manchester	3,000,000 Cub. Ft.
Preston	1,500,000 ,,	New York	1,000,000 ,,
Southport	750,000 ,,	Newburgh, N.Y.	350,000 ,,
Tottenham (Second Contract)	750,000 ,,	St. Joseph, Mo.	750,000 ,,

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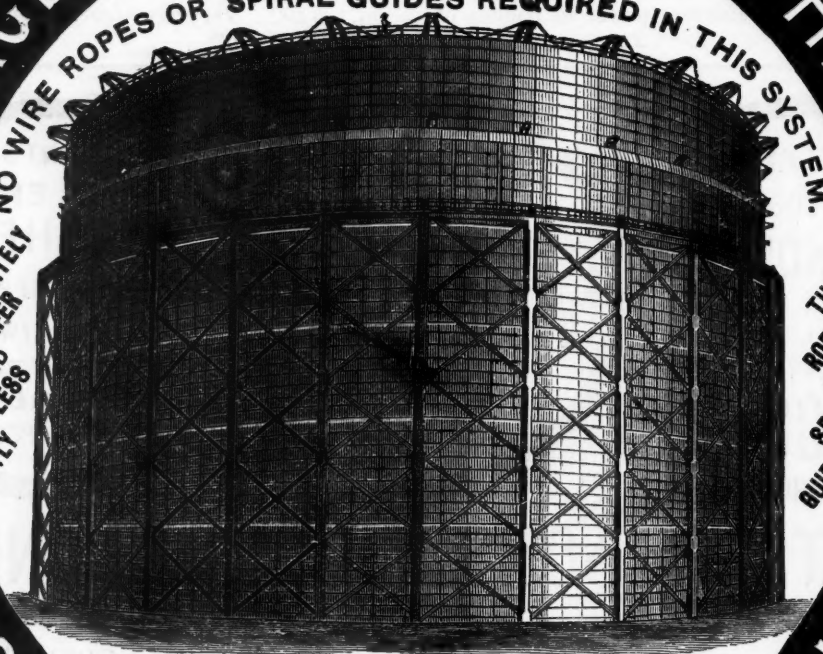

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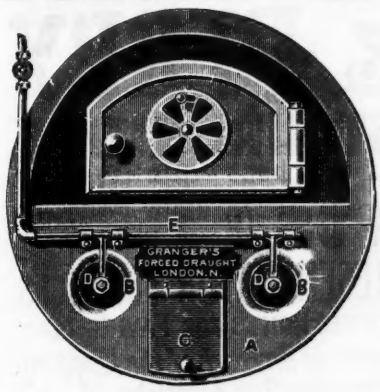

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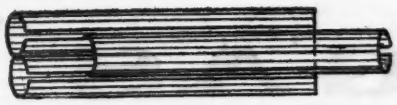

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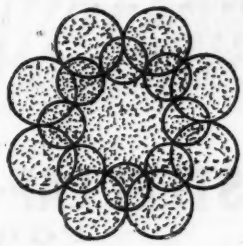

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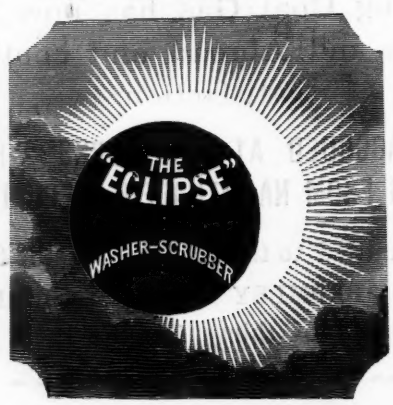

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